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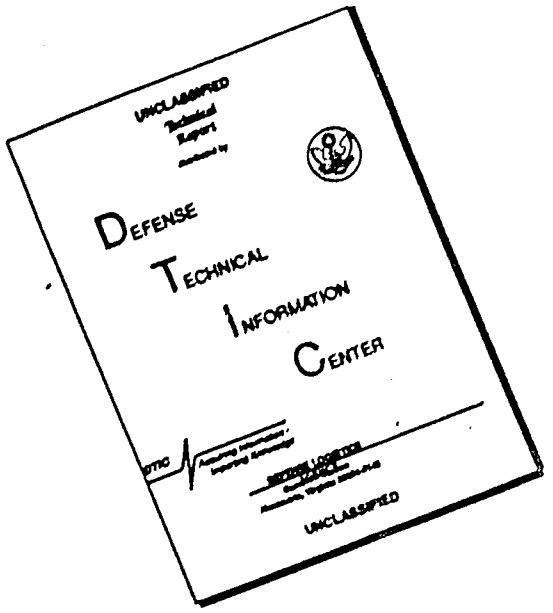

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PROJECT PIMO FINAL REPORT

PIMO TECHNICAL DATA PREPARATION GUIDELINES

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SERENDIPITY, INC.

FOREWORD

This report (Volume I through Volume VIII) represents the final phase of a study and test which was initiated in September 1964 to explore newly developed techniques and devices for presenting T. O. (Technical Order) type instructions and information. The eight volumes of data contain the result of a test conducted in an operational environment using concepts developed during an earlier phase under Contract AF 04(694)-729 and documented in BSD-TR-65-456. Both the early phase and final phases which were accomplished under Contract AF 04(694)-984, Project 1316, "Presentation of Information for Maintenance and Operation (PIMO)", were started in June 1966 and completed in April 1969. This final report was submitted in May 1969.

The original program documentation was prepared by Mr. C. L. Schaffer, SMTE, in 1964. He subsequently functioned as the Air Force Program Director and Chairman of a Working Group which monitored all development throughout the life of the project. This Group was composed of individuals from various Air Force commands (AFLC, MAC, ATC, ADC, AFSC) and the Army Command (AMCPM, AXMLE) knowledgeable in the various maintenance disciplines and all facets of the T. O. system. Capt. Don Tetemeyer, the Project Scientist during the formulative stages of the Program was largely responsible for the basic test structure. Mr. John Saunders was the monitor for all contractual aspects until his reassignment in 1968.

Any success one may attribute to the project must be shared by numerous individuals; however, major credit and appreciation are due General Howell M. Estes, Jr., Commander of the Military Airlift Command, who provided the C-141A aircraft and the bases at Charleston, Dover and Norton for the operational test. Sharing in the credit for the MAC contributions are Lt. Col. Don Watt and his staff at Hq. MAC, and Col. Foreman, Col. Henzi, W/O Van Riper and all the personnel at Charleston Air Force Base and also at Dover and Norton who participated in the test. The hardships imposed on their organizations are recognized, and we sincerely appreciate the special efforts put forth to overcome all obstacles. The test could never have been conducted without the cooperation and competent performance of these many individuals.

We are especially indebted to the Air Force Human Resources Laboratory, Wright-Patterson Air Force Base for their financial contributions at a critical point in the project; and also to the Army Materiel Command, who believed the test potential of sufficient magnitude to warrant the expenditure of their funds. We are most grateful for their confidence and assistance. It is most assuredly the primary factor that permitted completion of the test.

This technical report has been reviewed and is approved.

D. A. Cook, Lt. Col. USAF
Hq. AFSC (SCS-2)

ABSTRACT

This report describes the latest phase in the program to develop and evaluate PIMO (Presentation of Information for Maintenance and Operation); a job guide concept applied to maintenance. Between August 1968 and April 1969, a test was conducted at Charleston AFB, South Carolina, to determine the effectiveness of PIMO. Three immediate behavioral effects were expected: 1) reduction in maintenance time, 2) reduction in maintenance errors, and 3) allow usage of inexperienced technicians with no significant penalty. Experienced and inexperienced Air Force technicians performed maintenance on C-141A aircraft using PIMO Job Guides presented in audio-visual and booklet modes. Performance was measured in terms of time to perform and procedural errors. The performance was compared with the performance on the same jobs by a control group, i.e., experienced technicians performing in the normal manner. The following conclusions were drawn from the test results: 1) after initial learning trials, both experienced and inexperienced technicians using PIMO can perform error-free maintenance within the same time as experienced technicians performing in the normal manner, 2) inexperienced technicians perform as well as experienced technicians when both use PIMO, 3) there is no significant difference between audio-visual and booklet modes, 4) the users revealed an overwhelmingly positive reaction to PIMO, and 5) the performance improvements provide the capabilities to significantly improve system performance defined in terms of departure reliability, time-in-maintenance, and operational readiness. This report also presents a description of the recommended operational system, specifications and guidelines for PIMO format development, including troubleshooting.

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SECTION I

INTRODUCTION

A. GENERAL

This document presents practical guidelines for the preparation of the job guide formats. They were developed during a two-year period in which certain technical orders for the USAF (Lockheed, Marietta) C-141A Starlifter Aircraft were reformatted and updated. The guidelines are intended to supplement the associated Job Guide Specifications with the primary purpose of aiding the procuring agency in its efforts to ensure a quality product.

The effectiveness of these guidelines has been demonstrated in that Serendipity employed relatively inexperienced personnel to accomplish the reformatting task. As a result, a more than satisfactory product was realized.

B. APPROACH

As a basic premise, technical manuals are to be regarded as a part of the tool complement used by technicians in the maintenance of hardware systems. The efficiency of any tool is predicated upon its interchangeability or versatility, and these attributes are obtained in greatest measure primarily through standardization. The more that standardization can be applied to data tools, the more efficient they will be. Every part of the PIMO Job Guide is standardized.

Another concept underlying development of job guides is that simplicity allows familiarity. In the PIMO development program, simplifications of data presentation have been engineered according to rigorous Human Factors criteria. For example, the number of callouts on an illustration is limited, and component names have been used rather than numbers, thereby reducing the technician's memory load and eliminating

the intermediate associations concerning callout numbers. Also eliminated is the confusion of conventional manuals in which different numbers call out the identical component on different illustrations.

A further example of scientific standardization in the job guides is the verb list. (Refer to Appendix). Verbs are the action in the language of the technical manuals. Verb diction allows simple instructions and acts as the fulcrum of performance accuracy. In the genesis of these guidelines, every communicative element of the technical manual was examined relative to system requirements. Every verb appearing in USAF technical training manuals was listed. The resulting list was analyzed by USAF maintenance technicians who were requested to rank the verbs in order of meaningfulness. In this manner, PIMO writers were provided with a highly refined reference for the reformatting of T.O. data as job guides.

C. PROCEDURE

There are two major functions associated with development of a job guide: planning and writing. They are of equal importance in producing a quality product. However, the planning function will normally require more iterations and synthesis than the writing function (usually associated with a job which is more "complex").

Inputs to the planning function will vary as a consequence of design (e.g., new systems versus extant systems). The output of this function will always be the same. With this process, the writing function becomes more "automatic" which, among other things, allows more consistent quality and production control.

D. GLOSSARY

There is a certain amount of nomenclature which is intristic to PIMO Guidelines. Although the meanings are not new, the precise allocation of names might be. The nomenclature and their definition are listed below:

Step -- Simplest maintenance action performed (e.g., set PWR to OFF) written as a sentence.

Task -- A group of three or fewer steps totaling not more than 25 words.

Maintenance Function -- A group of tasks performed by a technician to accomplish a particular result on a component or system (e.g., remove engine).

Function Group -- All maintenance functions applicable to a specified component or system.

Activity -- Maintenance function procedures performed on a system or component (e.g., operational checkout of Main Landing Gear).

Page -- A single page of maintenance tasks with accompanying technician viewpoint illustrations of the equipment to which they apply.

Input Conditions -- Information needed by the technician to enable him to prepare the equipment for beginning the activity. These data are in list form with no illustrations. They are presented on the first page(s) of the activity.

Standard Operating Procedures (SOP's) -- An SOP is an activity or a portion of an activity which applies to any one or all of the members of a class of components. For instance, if maintenance functions for all turnbuckles on the aircraft can be performed in an identical fashion, one SOP procedure would suffice. Portions of an activity common to many components and systems may also be written once and used repeatedly. An example might be the energizing of an aircraft system by means of specific circuit breakers.

Output Conditions -- A list of activities on the illustration of the last page of an activity specifying to the technician what must be done next. These are the only cross references to other activities in the PIMO conventions.

E. GUIDELINES

Guidelines are presented in several sections. The first section generates component and/or system boundaries for which activities are to be prepared.

The second section examines the function labeled, "planning"; the acquisition, assembly and analysis of the data required for input to the writing function.

The next major section includes the guidelines for writing PIMO Job Guides for the five maintenance functions: Remove, Install, Adjust, Operational Checkout, and Calibrate. Troubleshooting is treated in a separate volume of this report.

SECTION II

DEFINING THE DATA BASE

A. INTRODUCTION

Performance of this function is vital to ensure a complete set of technical data. It defines the activities for which procedures must be written.

By considering certain critical Human Factors parameters, it is possible to establish a data set which is compatible with the complexity of the hardware system and with the skills and experience of the (anticipated) maintenance personnel.

For descriptive purposes, reference will be made to only two levels of hardware: 1) end items, 2) subsystem.

An end item is a hardware element which can be removed as a unit. A subsystem is a group of end items performing a specific function. Examples of subsystems would be the high frequency (HF) communication system and the nose landing gear system.

B. DEVELOPMENT OF FUNCTION BY END ITEM MATRIX

The first step in developing this tool is to list all subsystems and end items associated with the major system. This will constitute the matrix rows. Matrix columns will be the five maintenance functions: Operational Check, Adjust, Calibrate, Remove and Install.

Matrix cell entries (i.e., activities) will be, initially, a mark indicating which maintenance functions can be performed on the subsystems and end items. The completed matrix represents the "candidate" data base. Inclusion criteria must be applied to establish the final base.

C. INCLUSION CRITERIA

Each cell entry (activity) must be examined relative to the information required to perform the maintenance functions. There are five information types to be considered. They are: 1) tolerance, 2) sequence, 3) location, 4) step, and 5) supportive (e.g., notes/cautions/warnings, special tools).

SECTION III

PIMO JOB GUIDE DEVELOPMENT

A. GENERAL

To ensure a quality product, a considerable amount of analysis (planning) is required before actually writing each maintenance activity. This analysis consumes the majority of procedure development time. The purpose of the planning function is to establish the detailed requirements so the writing activities will fit its intended use.

Because handbooks could be written to the PIMO specifications when a system is under development -- as well as after a system has been acquired by the Air Force -- planning is discussed for both types. In either case, though, the planning outputs must contain the same information. The following paragraphs treat the inputs needed and functions performed by the planner, and the outputs developed for the writing function.

B. INPUTS TO PLANNER

Three inputs are required regardless of whether the system is under development or is presently in existence. The first is the data base which the writing must cover. The second is the set of assumptions about the knowledge of the user (the 3-level technician) for whom PIMO Guides are to be written. The third is the assumed capability of the user.

Under current USAF training, it can be assumed the 3-level technician knows the following: topography of the aircraft in question, general safety information, the need for an accurate and fast job, general aircraft operating information, proper selection of common tools for use on the job, location of components on the aircraft by using fuselage

station numbers. It is also assumed that the 3-level is capable of using the correct tool, opening and closing circuit breakers, gaining access to aircraft component locations, and obtaining required supplies, parts, special tools or test equipment.

1. Inputs for Planning an Extant System

For an operational aircraft, planning should be done on one system at a time by collecting all the task and pictorial information for all activities related to the system from the organizational manuals, drawings, etc., already in existence. This creates the data base. Additional pictorial information may be obtained from the technical manuals, engineering drawings, and time compliance technical orders. Since the existing technical orders are not written within the 3-level capacity, experienced 5- and 7-level technicians should be interviewed and the aircraft itself inspected.

2, Inputs for Planning a Development System

Writing maintenance activities for a system under development requires the same information as indicated above, although the form and source of the information will d ler.

Inputs to the planner are as follows:

a. A list of the tasks for each maintenance activity per system, stating:

(1) Number of technicians involved.
(2) Time requirements for entire activity.
(3) Time requirements for each task.
(4) Location of technician per task.
(5) The sequence of tasks for each technician and sequence between technicians.
(6) The component, subassembly, or subsystem the technician works on during each task.

(7) Notes, Cautions or Warnings specific to a task called out prior to the task.

(8) Supplies required per task per technician. Quantity, name and number.

(9) Special tools: test equipment needed per task per technician, quantity, name and number.

Note: Above data, in part, may be obtainable from QQPRI analysis and documentation under AFSCM 375 series, notably, Requirements Allocation Sheets and accompanying Function Flow Diagrams. Depending upon documentation requirements of the given contract, regarding the fulfillment of 375 data or AFSCM 80-3, data of this type should be in existence by the time planning is begun.

b. Functional drawings of all aircraft systems showing well-defined input and output states between functions with regard to information, material or energy flow.

c. For each system, data showing location and configuration of each end item, access for replacements, adjustable parts, adjustment tolerances, conditions under which adjustment or calibration is necessary.

d. Weights of all removable parts, along with identification of any material necessitating special handling (e.g., glass, mercury, uranium).

e. Identification of specific circuit breakers (or procedures) which energize each end item or subsystem, etc.

f. Identification of components and subsystems with their related hydraulic system and any relationships to other hydraulic systems, either pressurized or depressurized.

g. Identification of all removable components or subsystems which have been used previously on other aircraft and the identification of those aircraft. (Good documentation should be available on such items). Identification of all components which are identically mounted or connected across or within systems.

h. Complete pictorial information, as found in engineering drawings, artist's renderings, photographs or mock-ups of component systems.

C. PLANNING PROCESS

1. Extant Systems

When planning actually begins, the impact of the different input forms for the developing and existing system becomes clear. The following is a brief breakdown of the planning function for an existing system.

a. Using the data base, assemble all relevant data for the first system to be planned. Group any available pictorials with the maintenance tasks they support. It is recommended that the planning of each system begin with the Adjust activity.

b. Become familiar with the T.O. procedures and the equipment involved.

c. Interview senior maintenance technicians to determine how the activities should really be performed to be both safe and at the step level (as against the task level). Validate what is called for in the T.O. as needed, such as aircraft preparation, test equipment, part numbers, and number of technicians to do the job.

d. Obtain the preceding information first for the Adjust procedure, then system Operational Checkout, Remove, Install and Calibrate. Planning data for Adjust will be related to Calibrate. Determine whether or not the system may be adjusted in sections

and if so, what section must be adjusted after replacement of one of the components within it. Next, determine a brief, efficient way to check the adjusted section. This adjustment or rig check will be the first step of the Operational Checkout, to be planned next.

e. When planning the Operational Checkout, the rig check is useful as a prelude to troubleshooting and as a prelude to system checkout to separate any component out-of-tolerance problems from the system adjustment problems. If individual components can be checked out independent of the system, partition the system checkout into a series of component or section checkouts and include the rig check as the first major part within each.

f. Plan the Remove and Install activities, and integrate those into one activity. Identify what adjustment must then be performed on the component or system at the end of the initial activity and what Operational Checkout must finally be performed for that component or system. Also during the planning of the Remove and Install procedures, identify what panels or components were removed earlier to gain access and should so remain until the Operational Checkout is completed.

Assemble such data for all components within each system so the writer may prepare an activity showing those access panels, etc., which having been opened for Remove and Install procedures, must still be closed after system Operational Checkout.

g. Identify which components are removed in like manner based upon common hardware connections. Also identify what steps should be taken with the circuit breakers and hydraulic systems for the removal or application of electrical or hydraulic power. This should be done for each maintenance function.

2. System Under Development

While most of the work associated with the planning for the writer in the extant system is done after the available and relevant data have been created, the converse is true for planning maintenance activities for systems under development. The following is a set of general functions recommended for the performance of planning during a system under development.

Select all data from the available input which is related to the first system to be planned. Again, planning should occur in the order of Adjust, Operational Checkout, Remove and Install.

3. Adjust

a. With respect to the Adjust function, identify what portion of the system is affected by the adjustment, what portions of the system are directly adjusted (by physical manipulation) and what values and related tolerances around those values represent the output state for adjustment.

b. Identify the components in the system which are not affected by the adjustment.

c. Identify that information which will be available at each point during the system adjustment allowing the technician to know the values to be obtained and which items give the readout for the adjustment.

d. Determine what must be moved out of the way or removed entirely to allow access to the system to make the physical adjustment.

e. Identify which components within the system can be adjusted independently but which must be adjusted if the entire system is adjusted.

f. Based upon Quantitative and Qualitative Personnel Requirements Information (QQPRI) and/or the Requirements Analysis Sheets (RAS) plus other AFR-375 data, combine each maintenance task for

each Adjust activity with the proper pictorial information. Simulate each task, with data at hand, to check that it can be done considering access and safety and to determine that the supplies, special tools, test equipment, number of men, circuit breakers, hydraulic systems, etc., being specified in the data are correct and that the tasks are in correct sequence.

g. For those components which are individually adjusted, determine whether they are adjusted before, during, or following installation on the aircraft. If they are adjusted during installation, document this fact for the writer so the Remove and Install activity can be written as a combined activity including the adjustment. Items which must be done one way, but which cross functions, (Adjust, Opcheck, Remove and Install) should be combined into one activity to eliminate cross-referencing for the reader.

h. Supply all data needed to check system adjustment by ordering tasks for reading out the state of the entire system in terms of its adjustment. This will be the input to the planning of the system Operational Checkout. A rig or adjustment check is useful during both the opcheck and troubleshoot phases to eliminate the possibility of a malfunction readout due to the system being out of tolerance.

Once the adjustment has been planned, the next step is to similarly plan the Operational Checkout.

3. Operational Checkout

a. Using the schematics, function flow data and inputs of the system Operational Checkout tasks, determine what pictorial information is available for the components of the system which receive inputs and for those which provide readouts.

b. Determine whether an Operational Checkout can be performed on the individual component or if, due to the limination of its design readouts and lack of test equipment, they cannot be measured.

c. If individual components or small groups of components can be checked out, assemble the tasks for these and associate them with the correct pictorial information. Document whether the replacement of each component requires a component Opcheck or a system Opcheck.

d. A system checkout may be created by a combination of these smaller checkouts into one integrated package. Do this when possible to minimize the total number of activities a technician would have to utilize.

e. Once all the prepared information (supplies, state of the aircraft before maintenance, special tools, test equipment, number of men and skill level required, etc.) has been identified and the tasks and pictorials grouped by activity, establish the sequence in which the activity or subactivity should be performed.

4. Remove and Install

a. The Remove and Install activity planning is easier since the planner has by now been exposed to all the components, their configuration and connections during the planning of the Adjust and Operational Checkout. The planning involves grouping the data for the Remove and Install tasks, matching these with the correct pictorials, and placing them in the correct sequence. It is also necessary, as in all activities, to provide preparatory information (supplies, etc.).

b. All components within the system which are connected identically to adjacent structures should be identified so that one activity may be written which would cover several components.

c. For all two-man activities that exist for Remove and Install, separate the tasks for each man and clarify their chronological order for each man and between men. Link the appropriate tasks with pictorial information.

d. Specify whether or not the removal of one item necessitates first the removal of another component or opening of any access panels prior to actually performing the activity. List these components. If one component cannot be taken off without first removing an adjacent one, then prepare one activity package for the writer, integrating the Remove and Install functions for both components.

D. PLANNING CHECKLIST

Before beginning any writing on a system for which all planning has been accomplished, perform the following:

1. Check against the data base to see that all activities that were to have been planned have been planned.

2. Check that uniformity exists across components within the system as reflected in planning the packages for the activities with respect to such things as circuit breaker specifications, same or proper hydraulic systems specified for pressurization-depressurization, consistency in calling out the need for special tools or test equipment, and for the removal of connectors which mate to removable components.

3. Check also that Notes, Cautions and Warnings are consistent across activities where identical situations or tasks exist.

4. Check all Install activities to determine that the output conditions specified therein direct the technician to the correct Adjust or Checkout.

5. Check that any output conditions required at the end of an Adjust activity direct the technician to the correct Operational Checkout.

6. Check also that the panels or other hardware which may have been removed during a Remove and Install activity have been identified and that the last task on the Operational Checkout which has been

planned includes a system close-up procedure. Provide documentation so that the writer may create a close-up package, consisting of tasks for restoring anything on the aircraft which might have been disturbed during any one of the Adjust, Remove or Install activities for the system.

7. Ensure that partitioning of Adjust and system Operational Check-outs include all in-line removable components and that the nomenclature for each portion or section of these activities is the same as that contained in the output conditions of Adjust and Install activities.

Once these cross-checks have been made between activities for the system, planning packages for an entire system for all activities may be released for writing.

E. PLANNING OUTPUTS

Although the outputs of the planning function may be inferred from the previous discussion, a separate treatment of each output is in order. As noted previously, many commonalities exist across maintenance functions, for both the planning inputs and the planning process. This is equally true of outputs.

While the outputs are described below, their form is not treated in any special way. A form convenient for one user of this document may not necessarily be convenient for another. Outputs are listed generally in the order in which one might be exposed to them as he reviews an activity package.

1. Part identification (Remove and Install only).

2. Tools and equipment lists and identifying numbers.

3. Supplies (expendable, consumable items).

4. Personnel requirements and summary of their location and tasks.

5. Prerequisite status of equipment to be worked on, or the aircraft in general. (Such things as a specific hydraulic system being depressurized, or placing the aircraft on jacks).

6. Notes, Cautions or Warnings applicable to the entire activity which will be placed in the input conditions.

7. Electrical and pneudraulic de-energizing and depressurizing procedures as necessary. (There is an indirect requirement to isolate power from adjacent electrical system components with which the technician might inadvertently make contact.)

8. Step-by-step procedures for each man and pictorial information showing what the man will see and manipulate for each step.

9. Parallel step-by-step procedures for alternative hardware configurations found on different aircraft.

10. If activity segmented, as some Adjusts and Operational Checkout activities can be, the procedures should be produced in blocks coinciding with each segment.

11. Output conditions for each activity as required. The only probable output condition from Operational Checkouts will be the system close-up. Install and Adjust (and Calibrate) usually have output conditions directing to an Operational Checkout.

12. List of items removed but not to be installed until after Adjust or Operational Checkout is performed, (e.g., access panels).

SECTION IV

WRITING

A. INTRODUCTION

To have utility, the maintenance job guide procedures must reflect the specific information requirements of the user. The format finally developed for use in Project PIMO is the result of several years of analysis and research.

The PIMO format utilizes the inherent relative advantages of text and illustrations to optimally communicate maintenance procedures. In considering an inexperienced technician, one must realize that he does not know where the equipment is on the aircraft nor what it looks like. The information which tells him where the equipment is on the aircraft and what it looks like is presented, via the PIMO format, in illustrations. Information about what the technician is to do to the equipment is presented in the text. As such, this differs little from technical orders in terms of allocation of information responsibility to pictorials and textual material. However, the configuration, or the format, and the level of detail at which the information is presented are strikingly different.

(See Figure 4-1 for an example of the PIMO format.)

The following section explains the major principles of information presentation which form the basis for the PIMO format. These must be understood before the writer can effectively prepare procedures according to the PIMO Job Guide concept.

B. PRINCIPLES OF INFORMATION PRESENTATION

There are several requirements the job guide is to satisfy. The principles generated for presenting maintenance information were designed to meet these requirements. They are three-fold:

OPERATIONAL CHECKOUT OF AIC-18A INTERCOMMUNICATION SYSTEM — MAN A

Energize system.

NOTE

One of the two VHF NAV NO. 1 circuit breakers can be in one of three possible locations in upper left corner of avionics circuit breaker panel. A typical location is shown. Check to insure proper circuit breaker is closed.

1. Close and label the two VHF NAV NO. 1 circuit breakers.
2. Close and label the two TACAN NO. 1 circuit breakers.
3. Close and label MARKER BEACON circuit breaker.
4. Close and label the two ADF NO. 1 circuit breakers.

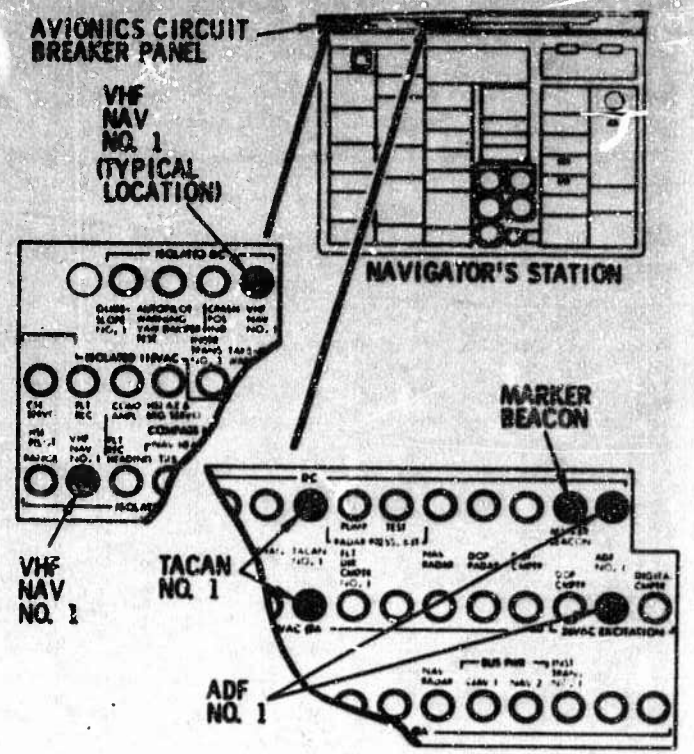

Figure 4-1 An Example of PIMO Format

- Effect maintenance with minimum possible errors by the technician.
- Effect maintenance in the fastest possible time consistent with lowest possible errors.
- Utilize inexperienced men to accomplish the maintenance.

To accomplish maintenance with fewest possible errors requires production of procedures which:

- are unambiguous,
- are easily understood by the technician as to intent,
- recognize the man's present knowledge and capability,
- allow for the physical conditions under which he must operate.

The writer accomplishes this with some difficulty. It requires that he constantly keep in mind the capability and knowledge of the typical inexperienced technician. To perform effectively, the writer must imagine himself as the technician and consider the needs of an inexperienced technician.

With respect to minimizing the time to perform maintenance, several considerations are important. Three factors contribute to time on the job over which the job guide can exercise control. One of these is the time required to read the text and look at the illustrations. The second is the time required to redo some portion of the job. The third factor over which limited control may be exerted is the time for moving from one work place to another. One of the inputs contributed by planning is an optimum sequence of tasks according to location to minimize such movement, thereby reducing time required to do the job.

The clarity with which one prepares text and specifies illustrations indirectly affects the probability of the technician having to redo a

portion of the job. If words and pictures are clearly focused, the need to redo a task is reduced to a minimum. The writer must constantly keep in mind the time required to read what to do and the time required to actually do it. Procedures could be written which would take considerably more time to read and to understand than to actually do the job. This situation must be avoided. Portray as much as possible of the total information in the pictorial for simple maintenance jobs or portions of jobs for simple tasks; information is extracted much faster from pictorials.

As earlier noted in the definition section, a task is comprised of up to three steps. Each step is an instruction for a discrete unit of work. If the job is simple, yet contains several units of work, present as much information as possible in the task. Since tasks are designed to be wholly read at one time, the ratio of reading to working will be in the favor of the working. Again, continual understanding of the technician performing maintenance will help determine the way in which a given procedure must be written.

The last of the three requirements identified is to prepare procedures for use by inexperienced personnel. The definition of inexperienced personnel is an individual who has just completed training on aircraft basics and is a "3-level" technician. He can be assumed to know only: what aircraft are usually comprised of at a gross level (e.g., wings, engines, fuselage, empennage, flight station, electronic, hydraulic, mechanical, pneumatic components, etc.). His training includes finding his way around aircraft by fuselage station numbers or other references imprinted on the aircraft, general aircraft safety considerations, the selection and use of common hand tools, and little more.

Another type of technician who will find the job guides concept extremely useful is the individual who changes from one aircraft to another about which he knows very little. Yet he may be considerably experienced on the original aircraft. So as not to "insult his intelligence"

with the PIMO method of writing, considerations for his growing knowledge about the aircraft can be implemented. These are described later, but basically constitute the use of subtitles to summarize the contents of a given page.

Psychological experimentation in immediate memory has indicated limits for the number of callouts on the illustration and the number of words and steps in a task. No more than seven callouts should be used in a pictorial, otherwise search time and recall are affected. No more than twenty-five words total should be included in a task. These words should be divided into a maximum of three steps. The requirement is that no more than three thoughts per task should be imposed upon the reader. The user should be able to read the task once, store it in memory, and do the job without having to reread it. These requirements result in higher speed of maintenance and a lower likelihood of errors.

C. PREPARATION FOR WRITING

Prior to writing, the planning input must be reviewed noting:

- what is to be accomplished,
- what specific steps are to be taken,
- time-related tasks,
- equipment configuration,
- importance of Notes, Cautions and Warnings.

One of the inputs will be the specification of what maintenance functions should be combined into one activity. For example, if a component must be adjusted after it has been replaced but before the installation is complete, then this is the way it should be written. The reason for combining activities into one package is simple: to minimize

cross-referencing. The way to do this is by combining maintenance actions into one package rather than sending the reader out to a separate activity.

In the PIMO procedures, all Remove and Install activities were combined, since it is very common that the Install immediately follows the removal of an item. If a component always has to be adjusted after installation, then combine this adjustment procedure with the installation. This will yield an activity entitled, "Remove, Install and Adjust". The criteria for combining more than one activity into a package should be well understood by the writer before he proceeds. Elaboration on this subject is presented later in this document.

The remainder of this document presents PIMO writing conventions in a modified job guide form, with features common to all types of activities explained and their generation discussed. Certain conventions differ according to the maintenance function. These are explained as the format is developed.

The job guide activity consists of two major sections. The first section of each activity is the preliminary information portion. These are designated on the input condition. Following the input condition are the actual maintenance procedures for performing the activity to its conclusion.

Input conditions are treated first since they are written first. Then the generation of maintenance procedures is treated in terms of both the physical characteristics of the contents and in terms of the convenience for evolving them. Special cases or exceptions are treated separately.

D. INPUT CONDITIONS

Figure 4-2 is a sample of typical input condition page. It contains many types of information denoted by headings.

REMOVE AND INSTALL AILERON POWER CONTROL SHUTOFF AND BYPASS VALVE ACTUATOR

INPUT CONDITIONS

Applicable Serial Nos.

All

Special Tools and Test Equipment

For install:

Torque wrench calibrated in inch-pounds

Supplies

One maintenance in progress tag, No. 1492
22 circuit breaker labels to indicate maintenance in progress
Six labels to indicate maintenance in progress

For remove:

Caps for covering electrical connector and receptacle

For install:

Mounting Screws, AN501AD416-10 (four for each actuator)

Personnel Required: Two

Primary technician starts at flight station, later moves to the applicable wing location.

Assistant will be required to install aileron lock.

Hydraulic specialist will be required if the hydraulic cart is connected.

Applicable IPB

T. O. 9H2-4-152-4, Figure 3, Manifold and Valve Installation.

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Figure 4-2 Typical Input Conditions Page

1. Personnel Required

The Personnel Required Section of the input conditions is the first entry to be written. As seen on the figure, the number and type of men required are stipulated and the locations where each performs his work is specified.

The number of people to be specified is the minimum required. The location of his work place is defined in terms of: where he starts, if he will later move; or where he is if he doesn't move.

Four types of "Personnel" exist, although not for the same activity simultaneously:

a. One technician

b. Assistant

c. Two or more technician team (Man A, Man B, etc.)

d. Specialist

Most activities for on-aircraft maintenance can be handled by one man. Sometimes an assistant is needed. He is purely to help and needs no job guide because the primary technician tells him what to do.

Some activities require two or more men to accomplish separate portions of the work. Therefore, each will need instructions.

Instructions for specialists are not presented in the text. He carries a USAF Form 35 for his specialty. However, when such a job needs to be done during the activity, the need for a specialist is called out in the input conditions. Indicate the task required of him. The specialist is not "counted" in the number of personnel.

Below are some examples of the "Personnel Required" section for

various members and types of personnel.

a. One Technician Needed

Personnel Required: One
Performs activity in flight station

b. One Plus Assistant Needed

Personnel Required: Two
Primary technician performs activity in flight station.
Assistant will be required for opening and closing panel.

c. Multi-Man Situation

Personnel Required: Two
Man A performs activity in flight station.
Man B performs activity at FS1198 near No. 4 emergency escape hatch.

d. Specialist Needed

Personnel Required: Two
Man A performs activity in flight station.
Man B performs activity at FS1198 near No. 4 emergency escape hatch.
Specialist will be required upon request to connect and operate external hydraulic power cart.
Specialist will be required to operate a portable crane (FSN3950-491-0446 or 3950-329-4210) with the aileron power unit sling assembly (3S00013) attached when this is requested.
A hydraulic specialist will be required if the hydraulic cart is connected.

2. Applicable Serial Numbers

This entry provides for the "effectivity" status of the particular maintenance activity. Here are listed the serial numbers of the aircraft

covered by this procedure. If the activity is applicable to the entire fleet of the aircraft type, then "All" would be entered.

3. Special Tools and Equipment

By definition, entries in this section are those tools or test equipment required for the performance of the activity which are not normally with the technicians. The planning function identifies the name and numbers of special tools so that the technician can obtain them prior to beginning work.

These tools should be listed as shown in the sample in Figure 4-3. The Maintenance Support Information Manual (MSIM) entry is appropriate here also. The MSIM is covered in more detail later in this document. Briefly, the MSIM contains reference information (e.g., engine trimming tables, rigging charts) necessary for some maintenance not amenable to job guide presentation. Such reference data are simply too extensive in size and scope to warrant presenting them other than in a separate document.

If a tool is needed only for Remove or Install, that can be explained. When reference data are needed, the manual is noted with the appropriate page(s) and/or figure number(s).

Figure 4-3 contains some examples of the listings under "Special Tools and Test Equipment":

a. Special Tools and Test Equipment:
Transceiver Test Set, URC-4 or URC-11
Maintenance Support Information Manual, page 3-1,
Figures 3-2, 3-3.

b. Special Tools and Test Equipment:
For Remove:
Torque Wrench, Calibrated in in., lbs.

REMOVE AND INSTALL AILERON CONTROL COLUMN CABLES

INPUT CONDITIONS

Applicable Serial Nos.

All

Special Tools and Test Equipment

For remove:

Control System Rigging Kit, 3500009

For install:

Tensiometer, FSN 6635-530-1128
Brush

Supplies

22 circuit breaker labels to indicate maintenance in progress
One maintenance in progress tag, No. 1492
Six labels to indicate maintenance in progress

For remove:

Cable identification tags
Cable guide wire

For install:

Grease, MIL-G-21164
Lubricating Powder, MIL-M-7866

Equipment Condition

Applicable pilot's, copilot's and observer's seats must be removed.

Applicable IPB

T. O. 1C-141A-4, Volume II, Figure 52, Primary Control Cables.

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Figure 4-3 Special Tools and Test Equipment

For Install:

H.F. Antenna Sling, 3S60000

c. Special Tools and Test Equipment:

Man A: Gauge, push-pull dial 5210-882-5739
Control System Rigging Kit, 3S00009

Man B: 10-foot extension ladder
Rudder Lock, 3S0006-101

4. Supplies

Supplies are those (consumable) items which may not normally be carried by the technician, yet do not qualify as special tools or test equipment.

Again, the name and number should be written as in the example. If they differ for portions of an activity (as with a combined Remove-Install activity), they can be broken down the same as the Special Tools and Test Equipment section may be.

A common type of supply is a specified number of labels to identify circuit breakers, as these are not to be touched during the course of the activity. The need for these is written as in the example below:

a. Supplies:
Safety Wire, MS20095CU
Sealant, MIL-S-8802
Nine circuit breaker labels to indicate maintenance in progress.

5. Equipment Conditions

Equipment conditions are those necessary states of equipment operation or configuration which must be present before maintenance can begin. Equipment conditions data should be another input to the

writer from the planning function.

For example, the aircraft must have electrical power available, as shown on the right. Or, in order to remove something from the top of a C-141A engine,perhaps the left-hand aft cowl door must first be opened.

Unless the state can only be achieved by a specialist, it can itself provide the genesis for a separate activity (e.g., "Open and Close Left-Hand Aft Cowl Door").

Another example of an equipment condition is shown broken down for Remove and Install. This example is not included as part of the activity procedures because all hoist work is done by a specialist.

Equipment conditions may also be used to specify "non-allowable" (e.g., "Aircraft must not be on jacks for this activity.") or when there are alternative ways to achieve the state, some of which should not be employed.

Examples of entries in this portion of the input conditions are:

a. Equipment Conditions:

External electrical power must be connected to aircraft.
Hydraulic test stand must be connected to aircraft.

b. Equipment Conditions:

For remove:
The universal hoist (3S80019) must be assembled with the HF antenna sling (3S60000) and the hoist cable attached to the HF antenna before removal.

For install:
The antenna must be removed from the HF antenna cradle assembly (3S60001) and hoisted into position before installation can be performed.

6. Applicable IPB

NOTE: These data are only provided for Remove and Install activities and will probably not be available in a system under development until quite late.

This entry includes the T.O. number, figure number and title of the IPB containing detailed data on equipment configuration and part numbers for the end item(s) being maintained by this activity. It should be written as in the following example.

Applicable IPB

T.O. 1C-141A, Volume II, Figure 45, Power Control Rudder.

7. Special Messages (Notes, Cautions, Warnings)

Necessary information which the technician will be concerned with during the entire activity is placed in this area in the Input Conditions. If Warnings are required, they are placed first. Cautions, then Notes are presented after any Warnings.

Warnings are provided to preclude the possibility that the technician will harm himself. A common example is "Be sure that electrical power to system remains off during this activity." Another might be, "Be sure that all equipment and personnel are clear of control surfaces during this activity." An example of the form for a Warning is:

WARNING

The horizontal stabilizer is approximately 40 feet above ground level. All personnel must wear safety restraint harnesses while on this surface.

Areas around control surfaces must be clear of tools, equipment and personnel when controls are operated. Technicians must communicate positively to make sure observer remains clear of moving components.

Elevator is balanced by depleted uranium counterweights. Do not remain unnecessarily within two feet of counterbalance area.

The purpose of Cautions is to avoid any inadvertent action on the part of the technician resulting in equipment damage. Of course, Cautions specific to given tasks are also provided within the activity at the appropriate point. An example of a Caution:

CAUTION

Make sure there are no rig pins in the system before starting Operational Checkout.

Notes are used to provide additional information on anything that the technician must know during the performance of the activity. At the end of every input condition there is one last Note. This Note serves as a table of contents to the activity. The first entry in this Note, if there is more than one man, is a small title indicating Man A. Under Man A are those major functions he performs and the page number in the activity where instructions for these begin. Such things as de-energizing the system or depressurizing the system are first performed, so they are first specified.

When an assistant is used, he is provided one page immediately after the Input Condition to show him the location of and access to his work place. This page is called out first in the Note.

Therefore, this Note segments the activity, so that if the technician knows how to perform portions of it or if portions have already been

done, he can skip ahead.

Obviously, the procedure must first be written before this Note can be generated. An example of a typical Note is:

NOTE

Location and access information is on Page 2.
Man A
De-energize system starts on Page 3.
Depressurize system is on Page 5.
Adjust starts on Page 6.

Man B
Adjust starts on Page 13.

E. MAINTENANCE PROCEDURES

1. Location and Access Page

NOTE: This is applicable only to an activity in which an assistant is required.

While the location and access page is not generated by the writer at this point in the evolution of the activity, it is treated here because it follows the input conditions page.

An assistant in PIMO conventions does not do a complex job. His instructions are simple, and thus can be provided by the person he is helping. He needs no visual reference data during his performance beyond what he perceives from the equipment he is working on. However, he still requires information in order to begin his effort, primarily where the equipment he will work with is and what it looks like. This allows him to go to that location, get set up and await instructions from the technician he is assisting.

The location and access page, as explained above, is not developed at this point because the writer would not yet fully understand the tasks required. As the assistant's physical position becomes known, the location and access page can be effectively produced.

The access page essentially contains what can be seen in Figure 4-4. That is, a drawing of where he is to go will be related to the aircraft as a whole. Unless there is an unusual physical position he must take or something he must do prior to the other technician's beginning, a simple Note will be all the text that is required. The example contains a task, as well. However, a brief study of the page will allow him to get to his work station.

2. Writing Style

Two combinations of person and mood are used: Second person imperative for maintenance instructions, third person indicative for description or discussion.

Second person imperative mood is command language, telling the technician what to do (e.g., Set PWR Switch to ON).

The third person indicative mood shall be used for description and discussion. An example might be a Note which clarifies a given point yet does not tell the technician specifically what to do. It is simpler for the reader if a Note, Caution, or Warning does not inherently contain maintenance tasks, but only precautionary and advisory information as to a condition which must exist prior to or during the performance of the task which follows. Compound sentences should be used only where it is necessary to explain to the technician how something must be accomplished (as well as what). For instance, "Hold___ and slide ____out of _____", or "push and turn ____counterclockwise to disengage from ____".

Modifiers should not be employed if the pictorial can be used to convey the same distinction as the modifier. This is consistent with the

Access to aft vertical stabilizer ladder.

1. Set VERT STAB LIGHTS switch to ON.

NOTE

There are several ways to get to the vertical stabilizer ladders, depending on the position of cargo ramp and various doors. The following procedure can be used for any position of ramp and doors.

Climb a ladder to upper deck. Move aft to pressure bulkhead hatch. Pull hatch forward to open.

Move through hatchway and through access hole to vertical stabilizer ladders.

Climb forward ladder to horizontal stabilizer access door.

Rotate radial latch handle in clockwise direction and allow door to swing inward.

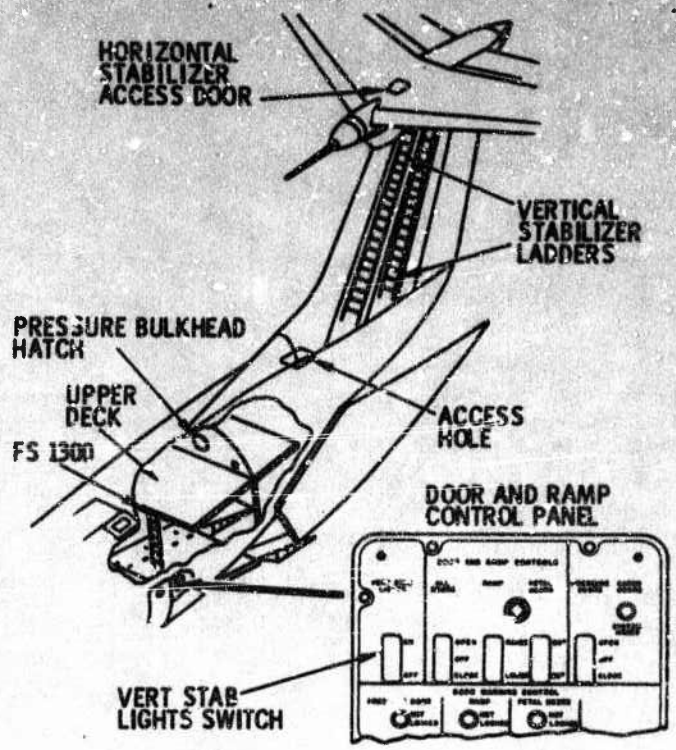


Figure 4-4 Example of Access Page

PIMO concept of using pictures as a means of discriminating and locating equipment.

If necessary, simple modifiers may be used (e.g., pilot vs. copilot, System No. 1 vs. System No. 2, etc.). To preserve simplicity of text, modifiers should be as short as possible.

Use verbs that describe the action, motion, or other characteristics of the task whenever this adds to the information about how the task is to be done (e.g., twist, slide, jerk, pull, push, etc.).

3. Syntax

The sentence structure explained below is the standard for the PIMO Job Guide concept. It is treated in terms of its elements as well as its structure. The elements of concern include: subject, verb, object, predicate object, indirect object.

a. Subject -- implicit only, except when more than one technician is required.

b. Verb -- using verb list*, select the verb which best describes the technician's behavior with respect to the object.

c. Object -- the specific equipment to which the technician's behavior is directed.

d. Predicate Object -- the term (or terms) which qualify the condition of the object (seldom necessary).

e. Indirect Object -- the location of the object (used only in unusual cases where pictorials cannot better provide such information).

---

* The verb list can be found in the Appendix.

The order of these elements within sentences is:
a. Subject, b. Verb, c. Object, d. Predicate Object, e. Indirect Object, or:

(a) (you--technician) (b) do something, (c) X to (d) state or condition Y.

An example would be:

(b) Set (c) RUD COMP switch to (d) OFF.
or
(a) (you--technician) (b) do something to (c) X at (e) location X, e.g., (b) lower (c) cargo door to (e) ground.
or
(a) (you—technician) (b) do something to (c) X (d) in state or condition Y at (e) location Z.
e.g., (b) Set (c) master switch to (d) NORM POSITION on (e) IFF CONTROL PANEL.

When a special tool is used, tell the technician he needs it in the following way:

a. Using, b. tool name, c. step statement, e.g., (a) Using (b) snap-ring pliers (c) pull bushing from hinge.

In the above examples, the subject is understood.

4. Nomenclature

The verb list found in the Appendix was compiled from analyzing the training materials to which new technicians are exposed. Each action verb from these materials which is a member of a synonym set has been given a rank of preference. This ranking was accomplished by means of technicians' opinions. Whenever a verb is needed, this list must be used.

Nouns are particularly important, both in terms of the need for accuracy and consistency in names.

If there is a name printed on the equipment or part, that name should be used. If there is no name imprinted, call it by the name assigned to it in the design process. Keep the nomenclature as simple as possible. For instance, the Frequency Tracker Test Switch may be called the test switch, or simply "switch", if no other switch has been mentioned already or is illustrated on the same page.

The technician will experience incidental learning as he works his way through an activity. The writer can take advantage of this by not repeating the same piece of information on every page. Once the technician learns the location of a given control panel, there is no need to reshow the location with regard to the aircraft or even to provide a name for the control panel. (See Figures 4-5 and 4-6). In some cases during highly repetitive work, repeated pictorial information is unnecessary.

Another point worth mention concerns the presentation of tolerance information. Numerical tolerance information must be provided as the last entry in the last step of a task. The primary reason for this is that numerical information is easier to retain in immediate memory if it is the last thing perceived.

To further guarantee and understanding, the tolerance will be given in the illustration adjacent to the applicable end item.

5. Energizing/De-energizing

A major portion of most activities is to apply or remove electrical power from the system or component which is undergoing maintenance. In modern aircraft, this is accomplished by closing or opening circuit breakers.

1. Rotate following to OFF:
   FUNCTION selector switch
   SCAN switch
   Both STC controls

2. Rotate following to zero:
   HDG SEL switch
   TILT control

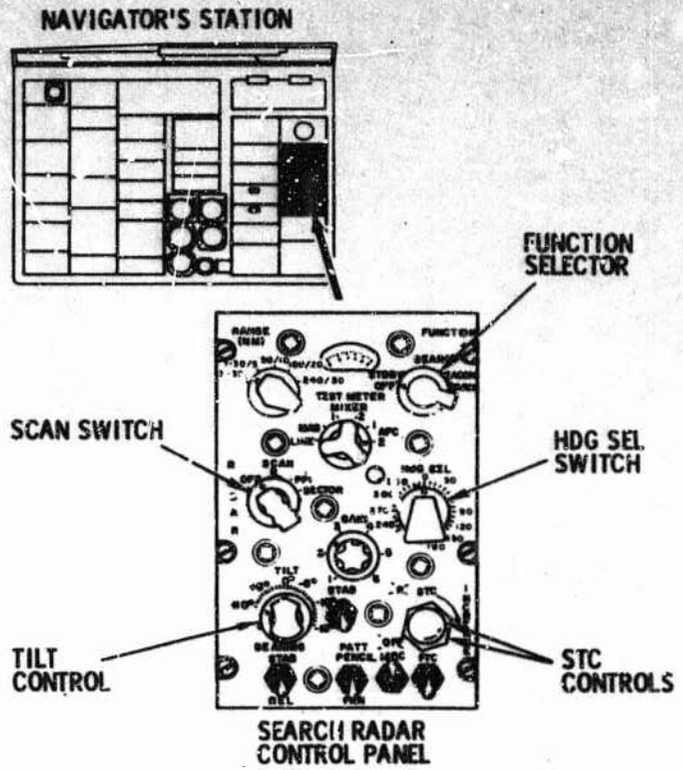


Figure 4-5 Example of Initial Panel Identification

1. Place five toggle switches in downward position.

2. Rotate both GAIN controls fully counterclockwise.

3. Place test meter mixer switch at line.

4. Place RANGE switch at 3-30/1.

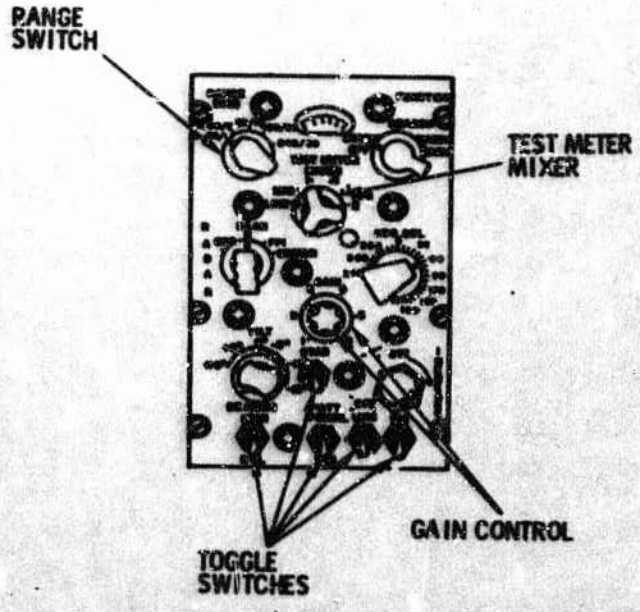


Figure 4-6 Example of Subsequent Panel Identification

Circuit breaker names and location data will be determined in planning. If the technician could inadvertently make physical contact with an adjacent electrical system component, then it will also be isolated.

If, as in Figure 4-7, there are several circuit breakers located on various subpanels within the same general location, begin by opening or closing, as applicable, those at the top left and proceed clockwise.

A listing convention is used when there is more than one circuit breaker to be opened or closed. The example shows the case where the task says, "Close and label the following circuit breakers." Circuit breakers are labeled before beginning maintenance so that no one will tamper with them while the technician is working. No more than three circuit breakers can be listed in one task. All circuit breakers on a given subpanel should be opened or closed before going to another panel. A master locator picture should be provided to show the technician the gross location of the subpanels, and detailed drawings of the circuit breakers on the subpanels. Figure 4-8 shows the writing and illustrating conventions when different circuit breaker names are involved or their location varies due to aircraft modifications.

For a combined Remove and Install activity, circuit breakers are opened and left open at the end of Install with the labels removed. An exception to this is a Remove and Install combined with an Adjust or an Operational Checkout, in which case at that point in the activity, the circuit breakers are closed to energize the system.

Operational Checkouts and Adjusts written as independent activities usually require that circuit breakers be closed and labeled; apply the same conventions as seen in Figure 4-9.

During multi-man activities, tasks should be sequenced in such a manner that maintenance does not begin until aircraft systems are

REMOVE AND INSTALL RUDDER POWER CONTROL SHUTOFF AND BYPASS VALVE ACTUATOR

De-energize electrical power.

1. Open and label RUDDER TRIM CONT circuit breaker.

2. Open and label RUDDER CONT POWER IND circuit breaker.

3. Open and label following circuit breakers:

   RUDDER CONTROL POWER SYS NO. 1

   RUDDER LOAD LIMIT VALVES

   RUDDER TRIM POS IND

   RUDDER CONT PWR SYSTEM NO. 2

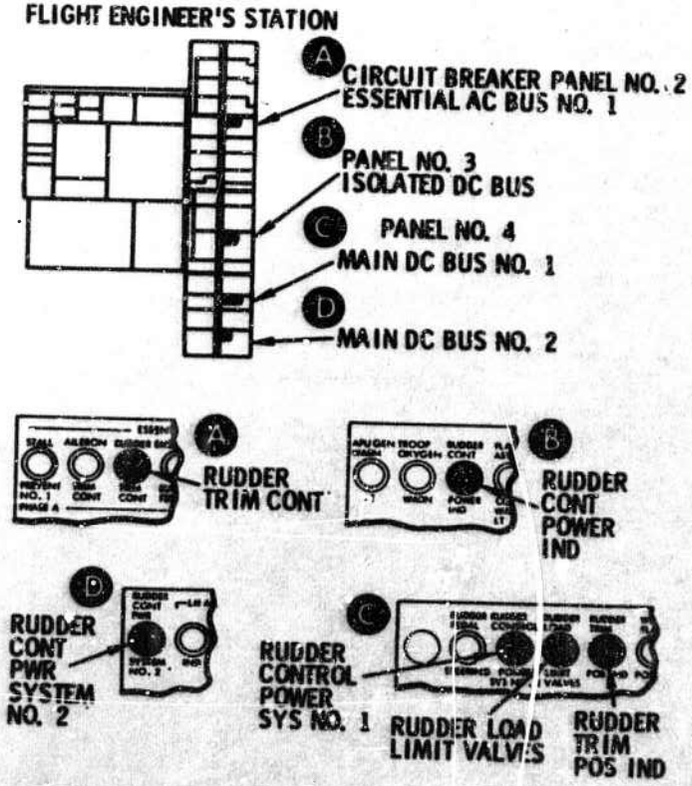


Figure 4-7 Example of Clockwise Ordering of Activities

1. Close and label following circuit breakers:

   COURSE SERVO

   COMP AMPL

   HSI AZ & BRG SERVO

2. Close and label following circuit breakers:

   INST HEADING TX2

   INST HEADING TX5

NOTE

NAV HEADING TX3 circuit breaker can be in one of two possible locations in lower right corner of avionics circuit breaker panel. A typical location is shown. Check to insure proper circuit breaker is closed.

3. Close and label NAV HEADING TX3 circuit breaker.

4. Close and label INST TRANS NO. 2 circuit breaker.

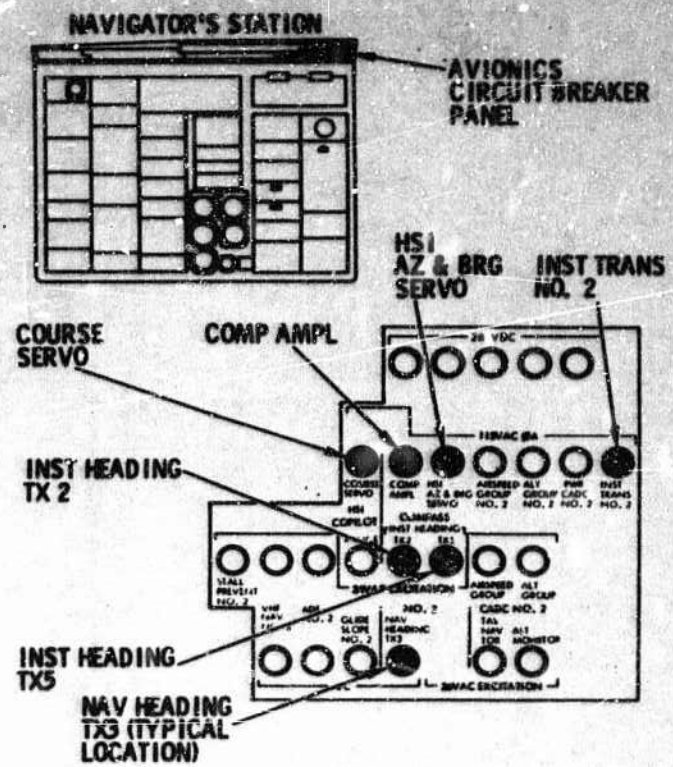


Figure 4-8 Example of Master Locator Use

Pressurize hydraulic system.

1. Check that interconnect handle is fully pulled out. Tag handle.

2. Set the six switches on hydraulic systems No. 1 and No. 2 panels to NORM or ON, as applicable.

3. Place rudder pedals in neutral position. Request that specialist pressurize hydraulic systems No. 1 and No. 2 to 3000 PSI.

WARNING

Be sure personnel and equipment are clear of control surfaces.

4. Report to man B. Alternately depress pilot's or copilot's right and left rudder pedals, as far as they will go, six times. Return pedals to neutral. Report to man B.

5. Check that pressure indicators show 3000 PSI.

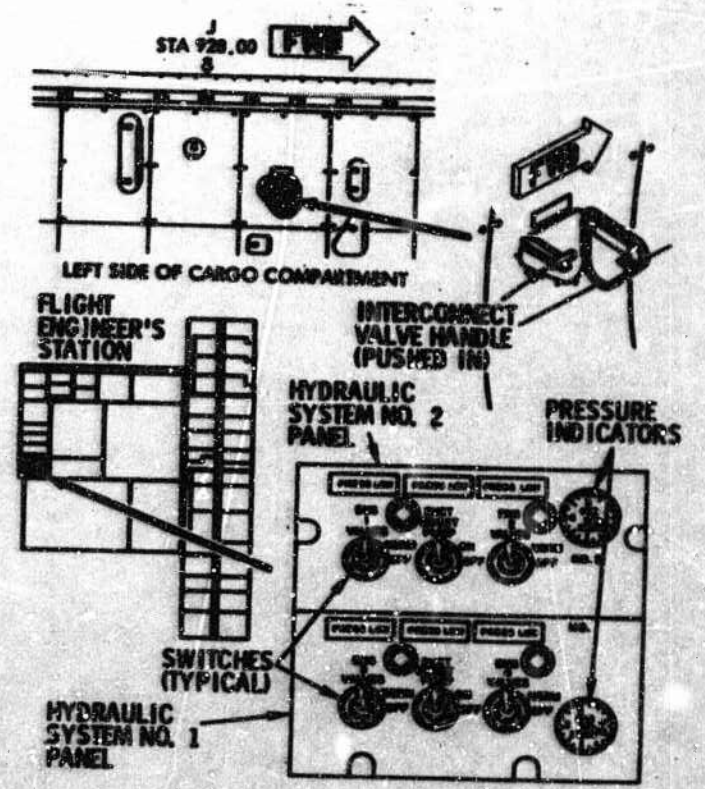


Figure 4-9 Example of Circuit Breaker Labeling

properly energized or de-energized.

The writer will find that a page written to isolate electrical power from a system can be used repeatedly for the removal and installation of every component within the system.

These standardized procedures should be given subtitles. The technician will no longer need detailed instructions after performing such a sequence several times. Subtitles allow bypassing of pages containing familiar procedures.

6. Pressurization/Depressurization of Hydraulic and Pneumatic Systems

There are no special conventions for generation of pressurization or depressurization pages.

These procedures are necessary to remove and install components within a hydraulic or pneumatic system. They are also needed for Adjust and Operational Checkout of components and the system. Therefore, each page prepared by the writer will be used in several activities (Figure 4-9).

Subtitles should be provided for these procedures.

SECTION V

MAJOR WRITING CONVENTIONS

A. INTRODUCTION

All of the preparation data and basic concepts of the writing style have previously been introduced. The next major topic for discussion is the writing of the activity.

B. RECURRING ACTIONS

1. Repeated Tasks

Occasions arise when a task must be repeated. The basic approach is to train the technician to perform the task the first time it occurs and thereafter to simply refer to the task. This requires a descriptive title for the task, e.g., take station bearing, check doppler, lock-on, etc. The approach also requires presentation of information concisely to facilitate retention. However, there are conditions which must be met before the repeated task approach can be used:

a. The task must in no way involve danger to the technician or the equipment.

b. Sequence of steps (a maximum of 4) within the task must not change.

c. The task must be repeated at least once.

d. Not more than 4 tasks or 7 steps may intervene between presentations of the task.

e. If numerical references or tolerances are involved, they must be repeated.

The ground rules for writing such tasks to be repeated are as follows:

a. Select a descriptive title for the task (e.g., check doppler, lock-on).

b. Provide a brief description (25 words or less) of what the technician is supposed to do and how the equipment responds. This should be in the form of a Note which precedes the task the first time it is written. This is called a Training Note.

An example of a Training Note follows:

NOTE

Doppler Lock-on is indicated when indicator light goes out after ground speed is selected on simulator.

1. Set SIMULATOR GROUND SPEED selector to 200 knots. Check that Lock-on occurs within 30 seconds.
2. Check for Lock-on within 30 seconds at each of 4 other ground speeds: 240 knots, 280 knots, 320 knots, and 400 knots.

To repeat this entire task at a later time, simply write a single step task using the descriptive title:

1. Perform doppler lock-on check.

Obviously, some judgment has to be exercised in deciding when to employ a Training Note based upon whether a task is very complex or repeated often enough to make it worthwhile.

2. Repeated Segments

While the "repeated tasks" convention was for the efficient repetition of a task, the repeated sequence convention applies when a group of tasks is repeated. The primary reason for the repeated sequence is that many of the systems are parallel on the two sides of the aircraft.

(An example would be the right main landing gear versus the left main landing gear, the pilot's control cables versus the copilot's control cables, etc.). Each side frequently requires identical treatment. Certain conditions must be met before a repeated sequence can be used:

> Two or more tasks must be repeated in sequence.
> If reference information is used, the same reference must hold true for each repeat.
> The tasks must be identical except a different control or display within the same set may be used (e.g., the set of controls associated with each ADF control panel).

The approach essentially is to provide an explanatory page at the beginning of the sequence which shows the controls and displays to be used, the set within which an individual control or display exists, the nomenclature used to refer to a set, and the location of the sets. (For instance, the pictorial on this frame would show the four ADF control panels within the flight station, labeled by name. See Figure 5-1).

Write the tasks non-specifically. Individual controls and displays cannot be identified in the text -- only the set can be identified; e.g., compass rather than pilot's or copilot's compass. If the technician should first attend to a certain set or to sets in some order not determined by other tasks, explanation should be provided in a Note.

The use of repeated sequence pages is usually confined to Operational Checkouts and Adjust activities rather than Remove and Installs, for obvious reasons. At the end of the page (or pages if necessary), he will continue with the activity by going on to the next page. This is what happens the first time around. The second time around, if the repeated sequence began on page 6, a Note will be supplied at the appropriate point in activity (say page 15). This Note will essentially say, "Go to page 6 for checkout of navigator's ADF control panel."

NOTE

Next 10 frames will be completed four times, once with each of following:

Pilot's (No. 1) ADF

Copilot's (No. 2) ADF

Navigator's No. 1 ADF

Navigator's No. 2 ADF

Navigator has two ADF panels. Top one is for ADF-1 (pilot's). Bottom panel is for ADF-2 (copilot's).

1. **Set VOICE CW switch on applicable ADF control panel to VOICE position.**

2. **Rotate band selector switch to 190-400 position.**

3. **Rotate tuning knob until 285 KC (kilocycles) appears on frequency tape.**

4. **Plug in headset at appropriate jack and turn on speakers at pilot's speaker switch.**

5. **Pull up on applicable ADF monitor switch and rotate clockwise to obtain comfortable volume. Check that audio feeds into both headset and speaker.**

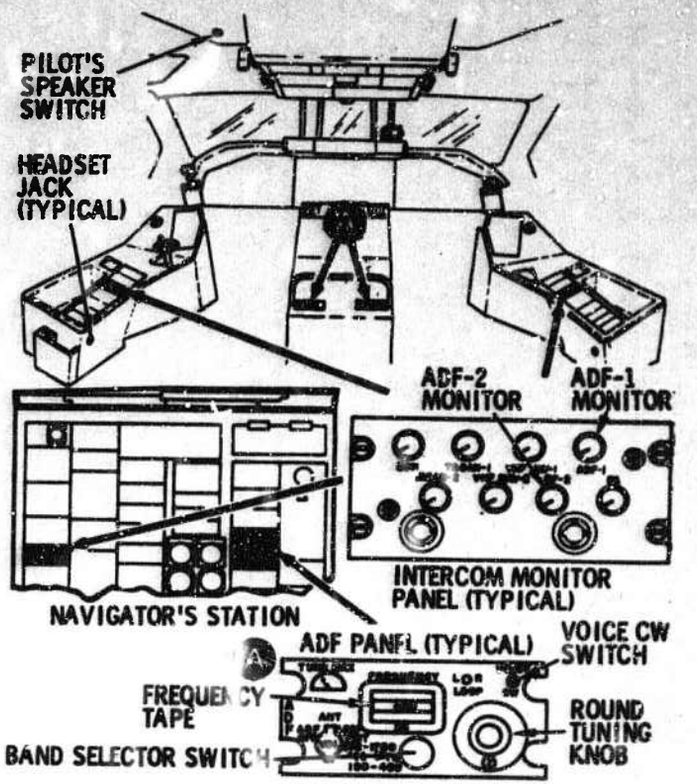


Figure 5-1 Example of Control Panel Labeling

The technician goes to page 6 and completes the tasks for the navigator's ADF control panel. How does he get back to page 15 if he does not recall the number?

A Note should appear at the end of the repeated sequence which says, "If this page was performed for Pilot's ADF Control Panel, continue to next page. If performed for Navigator's Panel, go to page 16."

This, "go to" convention allows the writer an efficient way to move the reader back and forth within the activity without getting lost and without any confusion. This technique is also referred to as the "branching" convention.

Figure 5-2 is such an example. The technician is told to repeat certain pages for all panels but is given a "way out" if he has already done so.

C. ACTIVITIES - GENERAL

1. Remove Activities

After the writer has reviewed the output of the planning function, to familiarize himself with the tasks required to perform the activity he should next determine where natural breaks occur in the activity. Breaks are of two types: 1) movement to a different location, 2) movement within a location in both geometric orientation and/or among ware items involved. Such breaks establish requirements for locator pictures (i.e., those relating the equipment to a larger unit of the aircraft which the technician already knows).

Locators must be selected for each major location. The pictorial used must show the item as the technician would see it. If it is not obvious how to gain access to the location (e.g., inside the vertical stabilizer of a large transport aircraft), it is necessary to include an explanatory note or a set of tasks with complete pictorials to explain how to gain access to the location.

Figure 5-2 Example of Frame Branching

NOTE

Frames 10 through 19 must be repeated for copilot's and both of navigator's ADF panels. If copilot's ADF check has just been completed, go to task 2.

1. Place function selector to LOOP on pilot's ADF panel. Unplug headset and move to copilot's seat. Repeat checks for copilot's (No. 2) ADF, starting on Frame 11.

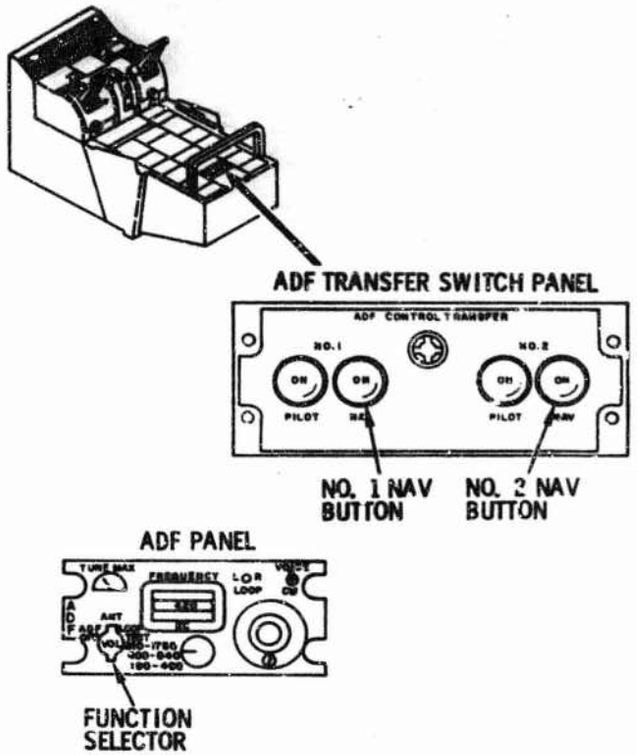
2. Push NO. 1 NAV and NO. 2 NAV buttons in on ADF transfer panel.

NOTE

If navigator's ADF No. 1 check has been completed, go to task 4. If navigator's ADF No. 2 check has been completed, go to next frame.

3. Place function selector switch on copilot's ADF panel to LOOP. Unplug headset and move to navigator's station. Repeat checks, starting on Frame 11.

4. Place function selector on navigator's No. 1 ADF panel to LOOP. Repeat checks starting on Frame 11.



When an activity requires an assistant to complete the action, instructions for that person must be delivered via the primary technician. Therefore, the instructions should be clear and simple. If the instructions are detailed and complicated, the activity should be treated as a multi-man activity which will be discussed later in this document.

The appropriate subtitles for each break in the activity based upon changes in location, changes in orientation and different hardware items being dealt with must be identified.

When writing the Remove activity, the items to be removed must be specifically named in the order of their removal. If more than one item of a given type (e.g., washers) is removed, the number must be specified. Any item that must be installed in a particular manner must be labeled prior to removal. Check whether it is possible that:

The part can be installed backward or upside-down,
it can be installed in the wrong order,
it can be installed in the wrong place.

When the number of parts to be removed in a given task exceeds three, the listing convention should be used. For example:

1. Remove the following from attach bolt:
   Cotter pin
   Nut
   Washers
   Spacer

or:

4. Slide bolt out of housing and catch the following parts:
   Washer, AN 04d617
   Spacer
   Bushing
   2 washers, AN706b714

If small parts differ and should be installed in a special order, they must be labeled in the order in which they were removed.

If items removed look similar, but are different in some ways (e.g., washers differing only slightly in thickness) the following procedure must be employed:

> Use the listing convention,
> Identify the part in text,
> Call out the part, including the number, in the pictorials.

Shims which are removed may have to be numbered so that the proper thickness is obtained during the installation; items removed must be called out on the pictorial, subject to the following:

> Common items readily recognizable in a pictorial (e.g., cotter pins, nuts, washers, etc.) need only be called out if they are somehow unique or require special handling which would be mentioned in the text.

2. Install Activities

Most of the same guidelines indicated for the Remove are employed in the Install portion of the activity. That is, the activity should be checked for major natural breaks and locators selected on that basis. It should be noted that the individual who does the Install may not be the same individual who does the Remove. Therefore, a major locator picture at the start of the Install must be employed so he can find the location where the item must be installed.

Any time labels were placed on equipment during the Remove portion they must be referred to (e.g., "connect five hydraulic lines to ports as labeled", or "match labels on wires and terminal lugs"). Tasks must be included at the end of Install to remove such labels.

If a set of items could appear similar to the technician when they are in fact different (e.g., in thickness), then the following should be done:

install all parts up to the one of interest (the different one); treat it in a separate task, calling out its distinguishing characteristic (e.g., the thicker or larger of the two washers) whenever possible. When it is not possible to distinguish because the difference in the characteristics is too small for easy perceptual discrimination, include any part number or dimensional information as a means of distinguishing.

Primarily during Remove and Install activities, it is common that access panels, doors, retainers and things of a similar nature be removed so that maintenance can occur. It is not practical to replace them until after the Operational Checkout, for the malfunction may not truly have been resolved, in which case access may still be required.

Therefore, a separate activity is written for each major system. It contains tasks to close whatever could have been opened during any one of the Remove or Adjust activities for a given system. The activity is broken down into sets of button-up tasks based upon each Remove and Adjust activity. (The technician would need to know what Remove or Adjust activity had been carried out on the system prior to the aircraft achieving an operational state.) The need for activities of this kind is determined by maintenance policies of the using organization.

In the PIMO procedures, only two button-up activities were done. These were to apply and cure aerodynamic sealant on mating surfaces of certain types of antennas. The curing time is approximately twelve hours, so it is not applied during the installation of the antenna but rather after an Operational Checkout is performed to see that the antenna is operating within tolerance.

Another way of handling a button-up activity would be to integrate it with the Operational Checkout of a system. This can be done if not too many button-up tasks for too wide a variety of end items are involved.

3. Adjust Activities

Adjust activities can be for a given component or for an entire system. For instance, the rudder trim actuator in the C-141A is by itself an adjustable component, yet it is part of the rudder control system.

Some adjust activities involve something more than the adjustment of an individual component, yet not as much as the adjustment of the entire system. The general area of flight control systems is a good example. Aileron cabling, torque tubes, power actuators, etc., extend through both wings. They are divided into a series of segments, or groups of components. Each segment is designed to be adjusted as an entity. The sequential adjustment of all segments yields a total system adjustment.

All sections of a system rarely need to be adjusted at one time. The technician will want to, and it is important for him to be able to, do the least work possible to bring the total system back into adjustment. The Adjust activity for some aircraft systems can be segmented so that the technician does not have to go through all the tasks for the entire system adjust, when in reality he only need adjust a given component group.

Figure 5-3 presents a sample input conditions page showing the modifications required when an Adjust activity is segmented. The most important change is noted in the last Note. Each segment is specified by name with the starting page reference. The output of an earlier troubleshooting function would have been to specify (if the malfunction is due to an adjustment problem) which section needs to be adjusted. The technician could enter the Adjust activity in one other way, as a result of having installed a new component.

The Adjust of a single component can probably be handled in a separate activity or a combined activity if it must be done during the installation or immediately at the end of installation. This becomes

ADJUST RUDDER CONTROL SYSTEM

INPUT CONDITIONS

Applicable Serial Nos.

All

Special Tools and Equipment

Rigging Kit, 3500009
Tensiometer, cable, 6635-639-1128
Gauge, push-pull, dial, 5210-822-5739

Supplies

Six circuit breaker labels to indicate maintenance in progress

Personnel Required: Two

Primary technician starts at tail cone, then works forward to forward bulkhead. Returns to tail cone to complete activity.

Assistant required in flight station during adjust and at end of activity. Moves to tail cone to observe and measure rudder movement as rudder trim switches are actuated.

Hydraulic specialist will be required to operate cart when requested.

Equipment Condition

External electrical power must be connected to aircraft.
Prepare for Rudder System Adjustment must be completed prior to starting this activity.

WARNING

Stay clear of moving parts while operating the rudder.

NOTE

Adjustment tasks for short cable runs will give desired rig tension. For long cable runs adjustment tasks will require use of rig tension chart to obtain desired tension. Following frames provide instructions for standard cable adjustment procedures:

Remove safety wire and mark turnbuckle is on Frame 3.
Use of rig tension chart is on Frame 4.
Use of tensionmeter is on Frame 5.
Adjust and safetywire turnbuckle is on Frame 6 and 7.
Adjust Rudder Control System at Rudder Trim Actuator starts on Frame 8.
Adjust Rudder Control System at Artificial Feel Spring starts on Frame 9.
Adjust Rudder Control System at Rudder Pedals starts on Frame 10.
Adjust Rudder Control System at Input Quadrant starts on Frame 11.
Adjust Rudder Control System at Power Control Assembly starts on Frame 12.
Adjust Rudder Control System from Input Quadrant to Interconnect Bellcrank starts on Frame 13.
Adjust Rudder Control System from Interconnect Bellcrank to Pedal Input Bellcrank starts on Frame 14.
Adjust Rudder Control System at Rudder Pedals starts on Frame 15.
Dynamic Rudder Adjustment starts on Frame 16.

Figure 5-3 Example of Input Conditions Page

somewhat judgmental depending upon whether there would be a need to adjust it independent of installation. In any event, all components adjustable within a system should be in one "system adjust" activity. A redundant activity for adjusting a component can be combined with a Remove and Install so the technician will not have to find it in the system adjust.

It was determined that for some systems (notably the flight control system) the initial preparation (e.g., de-energizing, depressurizing) was a common precursor to the Adjust of any segment. Therefore, for the ailerons, rudder, spoilers, wing flaps, etc., the activities were broken into two parts. The first part was a "prepare for Adjust"; the second part was the Adjust procedures for segments. The "prepare for" accomplishes such things as opening and labeling the system's circuit breakers, inserting rig pins into various input quadrants to provide a reference point for adjustment, etc.

Notice in Figure 5-4 that the first four entries on the list following the narrative paragraph are training pages. Each one of these jobs covered by the training page occurs quite frequently. Therefore, it is simpler to produce a training page which the man is able to reference or to learn the first time around as he works his way through the activity. Figure 5-5 is on such a page. Its application in any extensive way is not desirable, for it is incompatible with the job guide concept.

At the end of each segment, the reader is branched to a specific page by a note. That page contains tasks for "undoing" what was performed during the "prepare for" activity. Figure 5-5 is an example of a terminal page (in the rudder system Adjust activity) which an individual performing any segment would be referenced to in order to "out" of the activity. This page would contain an output condition requiring that the Operational Checkout now be accomplished.

Use of tensiometer.

NOTE

Different cable diameters will require different risers. Cable diameter will be given in adjustment tasks.

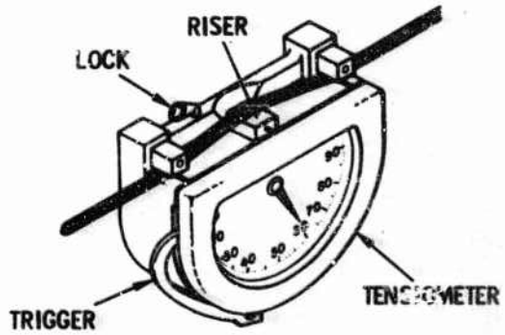
1. If wrong riser is on tensiometer, pull it off. Insert riser appropriate for specified cable diameter.

2. Pull trigger away from housing. Attach tensiometer to cable as shown in illustration.

3. On left most column of calibration chart, find and note specified rig tension or rig tension obtained for measured temperature.

4. Go straight to right to column appropriate for cable diameter and note tensiometer scale reading.

5. Close trigger against housing. Note scale reading shown on tensiometer. If tensiometer scale reading is not same as scale reading noted on calibration chart, adjustment will be required.



EXAMPLE ONLY

USE TABLE SUPPLIED WITH TENSIOMETER FOR READINGS

TENSION LBS.	RISER						
	NO. 1				NO. 2		
	DIA	1/16	3/32	1/8	5/32	3/16	7/32 1/4
30		12	16	21	12	20	
40		19	23	29	17	26	
50		25	30	36	22	32	
60		31	36	43	26	37	
70		36	42	50	30	42	

CALIBRATION CHART

Figure 5-4 Example of Training Entries

NOTE

Assistance will be required to observe and measure rudder movement as rudder trim switches are actuated.

1. **Place and hold rudder trim switches to NOSE RIGHT and release when rudder stops moving. Request assistant check that rudder traveled to right 6 (± 3/4) inches.**

2. **Place and hold rudder trim switches to NOSE LEFT and release when rudder stops moving. Request assistant check that rudder traveled to left 6 (± 3/4) inches.**

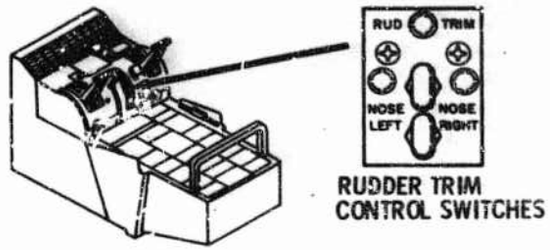
NOTE

If travel exceeded tolerance in either check, record current frame number. Replace rudder trim actuator and then return to this frame.

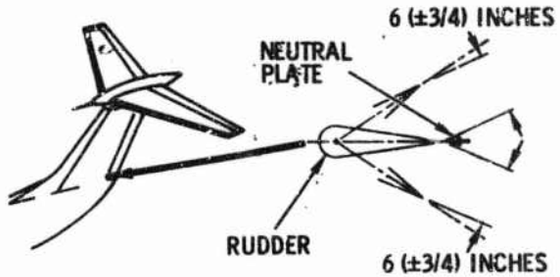
NOTE

The illustration contains a listing of the activities which must now be accomplished.

END OF ACTIVITY



RUDDER TRIM CONTROL SWITCHES



1. PERFORM AN OPERATIONAL CHECKOUT OF RUDDER CONTROL SYSTEM.

Figure 5-5 Example of Termination Page

4. Operational Checkout

The preparation of Operational Checkout activities enjoys many commonalities with that of Adjust activities. For instance, in some cases, the segmentation concept holds true for Operational Checkouts as well.

During the planning function, it may be possible to obtain design data and arrange it so as to achieve segmentation of Operational Checkouts. If an Operational Checkout can be segmented, by virtue of the equipment design and if the complexity of the equipment warrants it, then this segmentation is a result of the operation of a Maintenance Dependency Chart. Such a chart is a troubleshooting tool described in a companion report. The troubleshooting procedure should be identical with the Operational Checkout procedures; however, use of the Maintenance Dependency Chart and other troubleshooting aids as described, requires a more experienced technician. For this reason, Operational Checkouts must be written in the job guide configuration so that less experienced personnel can perform them.

If Maintenance Dependency Charts are not used for presenting troubleshooting information, then the decision to segment Operational Checkouts will require a trade-off. One should consider the availability of design data in a form suitable for segmentation, together with the amount of effort required to translate it into segments when contrasted with the time taken by the technician to go through an entire Operational Checkout.

Without the proper engineering data, it becomes extremely difficult to plan a segmented Operational Checkout (much less write it). If the PIMO Job Guide concept is being used to reformat technical orders for an existing system, information as to how Operational Checkouts can be segmented would be available from experienced maintenance technicians.

The Operational Checkout, in terms of entries on the input condition pages, could be written in a fashion similar to that of segmented Adjust activity. Also a "prepare for Operational Checkout" division may be possible, depending upon the type and number of commonalities between segments.

As with the Adjust, the applicable IPB section of the input condition is not appropriate -- since the major use of this is to assist the technician in finding the part number. Nothing will be replaced, so the part number is irrelevant.

The Operational Checkout activity requires that the system be energized and/or pressurized so that the system to be checked has all necessary inputs to allow it to operate within tolerance.

At the end of the Operational Checkout, write tasks to open the circuit breakers which were closed at the start, and remove the circuit breaker labels and any other "maintenance in progress tags".

D. ACTIVITIES - SPECIFICS

1. Multi-Man Activities

The PIMO writing convention for preparing multi-man activities is quite different than currently used in technical orders. PIMO recognizes that each man is physically apart from the other and is performing totally different tasks. Therefore, the convention is to write a separate set of procedures for each man, but package both sets in the same activity. Man A never reads the instructions for Man B and vice versa.

Writing a multi-man activity is probably the most difficult of all because it requires keeping a record of:

who is doing what at the moment,
the inter-man dependencies, and
their individual information needs.

The most effective way to write a multi-man activity is to take the list of tasks for each man (from the output of the planning function) and place them side by side. Read them both alternately and make notations in each one as to who must stop at a given moment and who must report to the other. Once this process is completed, it is possible to begin writing the tasks for each man. Both men must be considered as to their needs on the job and the relation of one man to the other in both performance and communication.

The ground rule used is that Man A is the individual who is most forward in the aircraft during the maintenance.

The procedures for Man A are presented first in the activity, after the input conditions. Man B's activity is inserted at the conclusion of Man A's activity. For instance, after the input conditions, Man A's instructions may take up the first ten pages. Therefore, Man B would begin on page twelve and continue through the remainder of the activity. Since Man A is normally in the flight station, it is his job to actuate circuit breakers and depressurize or pressurize hydraulic systems in preparation for the maintenance.

Several times during the activity, what one man does may affect either the performance or the safety of the other. In some cases, it is a requirement that one man perform some job before the other man can continue. The method for ensuring a smooth flow of work utilizing both men simultaneously is described in the following paragraphs.

The writer can have them communicate by employing special notes and requests to communicate integrated into tasks. If Man B cannot begin his effort until Man A de-energizes and depressurizes, then the first thing Man B reads on the first frame of his instructions is a Note which would say this:

NOTE

Do not begin until Man A reports system de-energized and hydraulic system No. 2 depressurized.

The key point is the report which Man A provides to Man B. A task is provided subsequent to the de-energization and depressurization tasks, e.g., "Report to Man B that system has been de-energized and hydraulic system No. 2 depressurized." Therefore, Man B would wait and do no work until Man A has opened the correct circuit breakers, has depressurized the hydraulic system and reports completion of these tasks to him. If no Note is provided to either man, then he can begin and continue, working independently of the other man with no requirements for communication until he comes to such a Note or task.

Figure 5-6 shows both text portions for Man A and Man B and provides an example of the dependency of one man upon another. It is also typical of the way notes and tasks are written to effect direct communication between technicians.

The input conditions for a multi-man activity differ slightly from those of any other activity. The following is a discussion of those portions of the input conditions which differ.

Special Tools and Test Equipment

Indicate special tools required for each man. If only one special tool is required and it is to be used by Man B, then write the following:

Man B:
Torque wrench, calibrated in inch pounds.

OPERATIONAL CHECKOUT OF AN/APX-64 IFF RADAR SYSTEM

INPUT CONDITIONS

Applicable Serial Nos.

All

Special Tools and Test Equipment

Test Set, ARM-123

Supplies

Two circuit breaker labels to indicate maintenance in progress.

Personnel Required: Two

Man A starts activity outside aircraft, approximately 50 feet from IFF antenna and operates test set.

Man B starts activity under fuselage to check installation of IFF antenna, moves to right underdeck avionics rack and then moves to copilot's station to operate IFF system controls.

Specialist will be required to operate electrical power cart.

Equipment Conditions

External electrical power must be connected.

NOTE

Notify base operations that a check of the EMERGENCY portion of the IFF system will be performed and request that they notify applicable radar facilities of the check.

NOTE

Man A: Set up of test set starts on Frame 3.
Operational checkout starts on Frame 7.

Man B: Location of components starts on Frame 15.
Set up of system starts on Frame 17.
Operational checkout starts on Frame 18.

Figure 5-8 Example of Two-Man Activity

Supplies

The same thing holds true for supplies.

A Note at the end of every input conditions should identify the division of labor between Man A and B with respect to the preparation (e.g., energization and depressurization) and the actual maintenance itself. Figure 5-6 shows an example of the way in which this Note should be written for a typical Man A - Man B activity. Notice that in a multi-man activity, the Note is broken down by individual, whereas in a one-man activity, the Note is broken down by the major function he performs). In the Man A - Man B situation the highest level breakdown is by man, and the duties are broken down in detail with page references. Both Man A and Man B must first read the input conditions, for they contain information for each. Subsequently, Man B can flip over the proper page to begin his work.

2. Combined Activities

As indicated earlier in this document, it is occasionally most efficient to combine various activities into one package, due primarily to the fact that:

a. One maintenance activity (e.g., Install) cannot be completed until another activity is performed (e.g., an Adjust).

b. The activities are always done in a certain sequence and one of them is only performed after a specific preceding one has been accomplished (e.g., Operational Checkout of a component after it has been installed).

There is no reason to force the technician to go to a separate activity when it can be combined with one which dictates its use.

It must be made clear here that each activity is by definition a set of instructions and pictorials relevant to a specified maintenance function

(e.g., Operational Checkout, Remove, Install, etc.). The PIMO convention is that each time instructions and pictorials are presented for a separate maintenance function, a new page must be used. This is true even if there is only one task for a given maintenance function.

Combined activities require input conditions to be modified in certain ways. If certain specific tools and test equipment or supplies are needed for a given function within the activity package, then they can be broken by maintenance function. An example follows for a case with a combined Remove and Install activity:

Supplies

For Remove:

Alaphatic Naptha, TX-493

For Install:

Engine Oil, 752-3931
Oil Container

The Personnel Required Section is organized by maintenance function. The Note at the end of the input conditions is also organized by activity with references to the starting page number. If a multi-man situation exists, it should be broken down by each man, and then further broken down by function.

The phrase "end of activity" tells the man he has completed the procedures for a given activity. It is placed in the center of the page on the text side after the last task of the activity. In a combined activity there may be several maintenance functions which are being performed, each of which has a finish. Although the heading will change at the top of the page as the man begins a new function, it is made more clear to the reader that a maintenance function has been completed by telling him so in the text. The way in which this is carried out for a combined activity (e.g., Remove, Install and Adjust_____.) is to write "end of

Remove" after the last Remove task, or "end of Install" after the last Install task, etc. However, after the last maintenance function has been carried out, END OF ACTIVITY should be written (rather than "end of Adjust"), for, at this point, the entire package has been completed. (See Figure 5-6).

Of course, the technician would be trained to understand that once one of the maintenance functions in the combined activity has been completed, he should continue through the remainder of the functions until the entire activity package has been performed.

One of the primary reasons activities are combined is so that cross-referencing can be minimized. This makes the PIMO procedures much more usable by the technician, and much more acceptable. However, it is not cost effective to combine some activities. The Operational Checkout of the entire system should not be combined with Remove - Install activities. This is because a given system may have 30 removable components. Subsequent to removing any one of these and installing a new one, it might be necessary that an Adjust be performed (and then practically always the Operational Checkout). If one were to combine the Operational Checkout (which is usually a relatively long activity), and occasionally a mandatory Adjust with the Install activity for each removable component, the result would be an unreasonable number of pages in the manuals.

Therefore, system Adjust and system Operational Checkout activities are referenced at the end of Install activities as the next in sequence. (The order of activities would be one output from the planning function.)

Output conditions are written in the following way, in the form of a task (preceding END OF ACTIVITY):

e.g., the following activities must now be performed:
Adjust Aileron Control System
Operational Checkout of Aileron Control System.

The output conditions could be one, two, or more items. There can be several items if Adjust activities and Operational Checkout activities for one or more components in a given system have been written in a series of segments. (Segmentation as a writing convention is described in another section.)

E. ACTIVITY REVIEW

1. Three major areas warrant review.

a. Completeness -- all input data from planner should appear in the activity.

b. Correctness -- all numerical values and equipment nomenclature should appear as given by planner.

c. Conformity -- all writing should conform to the specifications given in this document.

d. Specific checks prior to final production of activity:

(1) Input Conditions

Review activity counting the tags and labels and various other supplies. Compare these numbers to those values which appear under supplies in the Input Conditions. Repeat this action for Special Tools, Test Equipment, Personnel Required, etc.

Check that prerequisite equipment conditions are all specified explicitly and appropriately.

Be sure all generally applicable Notes, Cautions, and Warnings have been included and are correct.

(2) De-energization/Depressurization

Check that circuit breakers are opened left-to-right and that callouts and locators are arranged likewise. No more than four circuit break-

ers should be listed in a single task, and all circuit breakers for a given task must be on the same subpanel. Be sure all special problems, such as the same circuit breakers or different circuit breakers being in the same or different locations due to modifications between aircraft, have been handled appropriately and correctly.

Check that no more than seven circuit breakers are called out on any one frame. Check that nomenclature is consistent in each of the following: text, pictorial (equipment legend) and callout.

Be sure that the correct hydraulic system(s) have been depressurized and that the locators, switches, gauges, panels and callouts are correct.

(3) Maintenance Procedures

The following check items are those relevant to the maintenance procedures portion.

Be sure tasks have no more than 3 steps and are no longer than 25 words. Check that there are no more than 7 tasks per page, that syntax is correct and preferred verb forms are used.

There should be no more than 7 callouts on the illustration and callouts should be short (three words maximum).

Be sure the listing convention is used if applicable, and that it is used appropriately.

Check that the appropriate locator illustrations are used, (i.e., the best available from the point of the user). Use the locators only once unless a series of alternate locations occurs that may lead to confusion.

Labels should be used wherever required, and tags are used where appropriate.

Be sure that technician notes or records anything that must be known at a later time.

If assistants are used, check that the syntax is correct. That is, "request the assistant_____". Be sure locator is provided assistant if needed, and that locator appears on first page and on first page after the input conditions.

Check each compound sentence and be sure that the compounding is first necessary, then appropriate. Check that modifiers are really required, and delete them if text illustration will be clear without them.

It is very important that the branching notes be checked to make sure that they refer to the correct page (technician may become irretrievably lost in an activity if the writer sends him to the wrong page).

In all two-man activities, be sure that any notes telling one to wait include what he is waiting for, and that all "report to" tasks include the specific information that the other man needs.

Check that branching notes do not move the technician backwards unless it is necessary to repeat frames. Be especially sure that any backward branching does not create an endless loop (where the text always refers the technician to preceding frames only to lead him right back to the same Note). Make the Note complete enough so that regardless of what he has done or what he has left to do, the alternatives are clear as to where he should go in the activity.

Check that each new maintenance function begins on a new page.

Check that subtitles for each major portion of the activity have been used when appropriate, and that they truly represent the content of the function summary form. Be sure that the correct title is on each page, considering the maintenance function occurring (Remove, Install, Adjust, etc.) and whether or not it is a multi-man activity.

In Install procedures, make certain that labels are referred to in performing the tasks if labels were used during the Remove. Be sure labels were used wherever necessary.

Be sure that all parts removed during the Remove procedures are installed by the Install procedures (with the possible exception of button-up type components).

Check that all tolerances are correct in both text and illustration.

Be sure that if oil or fuel was drained for the Remove activity that appropriate fill instructions are in the Install. Be sure that this fill segment of the activity is noted on the input conditions and that oil type and quantity are provided in the supplies section.

APPENDIX

FORMATTING VERB LIST

In the following list, each verb is defined in terms of one or more meanings associated with aircraft maintenance. A sample sentence has been provided for each usage. A number entry in the preference rank column indicates the standing of that verb compared to others with the same or similar meaning (highest rank is 1). Any synonyms with which the verb was ranked are listed, in terms of their own ranking. If a synonym holds first rank, it is underlined. Where necessary, special notes are also included. Lower ranking verbs can be used when the first-ranked verb is particularly awkward or misleading in a given statement.

Revised 31 March 1967

VERBS	DEFINITION	EXAMPLES	PREF. RANK	SYNONYMS BY ORDER OF PREFERENCE	NOTES
Accomplish	To do, carry out or bring about; to reach an objective.	Accomplish a periodic inspection on the landing gear.	2	1. Perform 3. Effect	
Actuate	To put into mechanical motion or action; to move to action.	Actuate the handpump until the pressure gage indicates 3000 psi.	-		
Adapt	To make fit a new situation or use, often by modifying.	Use the bushing to adapt the fuse to the projectile.	-		
Add	To put more in.	Add water to the battery.	-		
Adjust	1. To bring to a specified position or state.	1. Adjust the micrometer to the given measurements	-		
	2. To bring to a more satisfactory state; to manipulate controls, levers, linkages, etc., to return equipment from an out-of-tolerance condition to an in-tolerance condition.	2. Adjust cable tension using the turnbuckles.			
Advise	To give information or notice to.	Advise man B that the brakes have been set.	4	1. Report to 2. Inform 3. Notify 5. Communicate to	
Advance	To move forward; to move ahead.	Advance the throttle.	-		
Agitate	To move with a jerky, quick or violent action.	Agitate the container so that the paint will be well mixed.	2	1. Shake	
Aid	To give help or support to; to assist	Aid man B to lift the load.	3	1. Assist 2. Help	
Alert	To warn; to call to a state of readiness or watchfulness; to notify (a person) of an impending action.	Alert personnel that area will be cleared.	-		
Align	To bring into line, to line up; to bring into precise adjustment, correct relative position or coincidence.	Align slot in turnbuckle barrel with slot in cable terminal.	-		
Allocate	To apportion for a specific purpose or to particular persons or things.	Allocate the various maintenance tasks to technicians.	3	1. Assign 2. Distribute	
Allow	1. To permit, to give opportunity to.	1. Allow the sediment to settle out.	1	2. Let	
	2. To allot or provide for.	2. Allow a 2-inch slack in the rope.	1	2. Leave	
Alternate	To perform or cause to occur by turns or in succession.	Alternate between pilot's and copilot's instrument test.	-		
Analyze	To examine and interpret test or inspection results to determine system or equipment condition or capabilities.	Analyze engine inspection findings to determine need for repairs.	-		

VERBS	DEFINITIONS	EXAMPLES	PREF. RANK	SYNONYMS BY ORDER OF PREFERENCE	NOTES
Apply	1. To lay or spread on.	1. Apply sealant to gap between the windshield and the aircraft structure.	1	2. Put	Use "lubricate" rather than "apply lubricant."
	2. To energize.	2. Apply power or load.	-		
Arrange	To group according to quality, value or other characteristics, to put in proper order.	Arrange components by size from smallest to largest.	1	2. Order	
Ascertain	To find out with certainty that a proper condition exists.	Ascertain that the light is off.	5	1. Be sure 2. Verify 3. Check 4. Determine	
Assemble	To fit and secure together the several parts of; to make or form by combining parts.	Assemble a jet engine in accordance with specified procedures.	1	2. Construct	
Assess	To determine the importance, size or value of; to evaluate.	Assess the success of the maintenance action.	2	1. Evaluate	
Assign	To apportion to for a specific purpose or to particular persons or things; to appoint to a duty.	Assign the various maintenance tasks to technicians.	1	2. Distribute 3. Allocate	
Assist	To give support or help; to aid.	Assist man B to lift the antenna.	1	2. Help 3. Aid	
Assure	To make someone sure or certain, to inform positively.	Assure other technicians that all warning lights are off.	-		
Attach	To join or fasten to.	Attach electrical leads to the multimeter.	2	1. Connect	Use "tag" in preference to "attach" a tag.
Back off	To cause to go in reverse or backward.	Back off nut to the nearest castellation.	-		
Balance	To equalize in weight, height, number or proportion.	Balance aircraft so that it is stable.	-		
Be sure	To confirm that a proper condition exists, to find out with certainty.	Be sure that the light is off.	1	2. Verify 3. Check 4. Determine 5. Ascertain	
Be careful	To exercise caution, to take care.	Be careful not to inhale the fumes of the solvent.	-		
Bend	To turn or force from straight or even to curved or angular, or to force, back to an original straight or even position.	Bend wire until it lies flat against the turnbuckle wall.	-		

VERBS	DEFINITIONS	EXAMPLES	PREF. RANK	SYNONYMS BY ORDER OF PREFERENCE	NOTES
Bleed	To extract or let out some or all of a contained substance from.	Bleed off tank air pressure	-		
Blow	To send forth air, particularly from the lungs through the mouth.	Check for obstructions by disconnecting the hose at the air inlet and blowing through it.	-		
Break	1. To separate into parts with suddenness or violence.	1. Never break safety wire to release air pressure.	-		
	2. To pull away.	2. Break the bead of the tire.	-		
Buck	To reseat or tighten rivets from the shank side.	Buck rivets to stop the leak.	-		
Calculate	To determine by arithmetic processes.	Calculate the voltage in a circuit with 10 amp of current and 5 ohms of resistance.	1	2. Figure 3. Compute	
Calibrate	To determine accuracy, deviation or variation by special measurement or by comparison with a standard.	Calibrate torque handles at least once each month so that the accuracy can be depended upon.	-		
Cap	To provide with a covering; to install or provide with a device for closing off the end of a tube which has a male fitting.	Cap all lines which have exposed msle fittings.	1	2. Install caps	
Care for	To take responsibility for the proper handling and upkeep of.	A mechanic calls for his tools.	-		
Catch	To prevent from falling to the ground, to capture.	Catch any fluid drippings in a drip pan.	-		
Categorize	To put into categories or general classes.	Cstegorize components by their function.	2	1. Cisssify	For determining the classification of a supply item, use "identify".
Center	1. To adjust so that axes coincide.	1. Center the nose wheei of the aircraft.	-		
	2. To piace in the middle of.	2. Center the pointer on the dial.	-		
Change	To replace with another compsrabie item; to substitute serviceabie equipment for msifunctioning, wornout or dsmaged equipment.	Change the switch contact points.	2	1. Repiace	
Channel	To form, cut, or wear a groove in.	Channel the rods so that they can be inserted essily.	-		
Charge	To restore the active materiais in a storage battery by the passage of s direct current through in the opposite direction to that of the discharge.	Charge the battery for a short time before making a specific gravity check.	1	2. Cycle	

VERBS	DEFINITIONS	EXAMPLES	PREF. RANK	SYNONYMS BY ORDER OF PREFERENCE	NOTES
Check	1. To confirm or establish that a proper condition exists; to ascertain that a given operation produces a specified result; to examine for satisfactory accuracy, safety or performance; to confirm or determine measurements by use of visual or mechanical means.	1. Check that the light is off.	3	1. Be sure 2. Verify 4. Determine 5. Ascertain	
	3. To perform a critical visual observation or check for specific conditions; to test the condition of.	2. Check the components for wear, deterioration or defects.	3	1. Inspect 2. Examine	
Checkout	To perform specified operations to verify operational readiness of a subcomponent, component, subsystem, or system.	Checkout the landing gear.	1	2. Test	
Chock	To place chocks adjacent to, and in front of and behind.	Chock main and nose landing gear wheels.	-		
Choke	To enrich the fuel mixture of a motor by partially shutting off the air intake of the carburetor.	Choke engine as required to start.	-		
Clamp	To fasten or press two or more parts together so as to hold them firmly.	Clamp the tensiometer to the cable by releasing the handle slowly.	-		
Classify	To put into categories or general classes.	Classify components by their function.	1	2. Categorize	For determining the classification of a supply item, use "identify."
Clean	To wash, scrub or apply solvents to; remove dirt, corrosion or grease.	Clean petroleum products from oxygen equipment.	-		
Clear	1. To move people and/or objects away from.	1. Clear the area.	-		
	2. To open the throttle of an idling engine to free it from carbon.	2. Clear the engine.	-		
Close	1. To block against entry or passage; to turn, push or pull in the direction in which flow is impeded.	1. Close the valve.	-		
	2. To set a circuit breaker into the position allowing current to flow through.	2. Close the circuit breaker.	-		
Coat	To cover or spread with a finishing, protecting layer.	Coat battery cables with grease.	-		
Code	To put into the form or symbols of a system used to represent words; to mark with identifying symbols.	Color code equipment parts.	-		
Collect	To bring together into one body or place; to accumulate.	Collect the required hand tools.	-		

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VERBS	DEFINITIONS	EXAMPLES	PREF. RANK	SYNONYMS BY ORDER OF PREFERENCE	NOTES
Communicate	1. To exchange information.	1. Communicate with man B during the entire procedure.	-		
	2. To make known.	2. Communicate to man B that the brakes have been set.	5	1. Report to 2. Inform 3. Notify 4. Advise	
Compare	To examine the character or qualities of two or more items to discover resemblances or differences.	Compare the readings from protractor and template.	-		
Compile	To compose or put together out of materials from several sources.	Compile the records of all maintenance on the specified aircraft.	-		
Comply	To conform with directions or rules; to accept as authority, to obey.	Comply with directions.	2	1. Follow	
Compress	To squeeze together; to condense.	Compress the forward and aft sections of the hydraulic pitch lever.	-		
Compute	To determine by arithmetic processes.	Compute the voltage in a circuit with 10 amps of current and 5 ohms of resistance.	3	1. Calculate 2. Figure	
Condition	To put into a proper state for work or use.	Condition components before installing them.	-		
Conduct	To lead, manage or direct.	Conduct the class in proper servicing procedures.	-		
Confer	To consult; to exchange views.	Confer with maintenance supervisor if necessary.	-		
Connect	1. To bring or fit together so as to form a unit, to couple keyed or matched equipment items.	1. Connect the torquometer to the socket wrench.	1	2. Mate 3. Join	
	2. To attach or mate (an electrical device) to a service outlet.	2. Connect the soldering iron to the service power outlet.	2	1. Plug in	
Consolidate	To join together into one whole, to form into a compact mass.	Consolidate contents of both containers.	-		
Construct	To make or form by combining parts; to fit and secure together the several parts of.	Construct a jet engine in accordance with specified procedures.	2	1. Assemble	
Control	To exercise restraining or directing influence over, to fix or adjust the time, amount or rate of.	Control electrical current generation and distribution.	2	1. Regulate	
Coordinate	To bring into a common action, movement or condition.	Coordinate the activities of man B and man C.	-		

VERBS	DEFINITIONS	EXAMPLES	PREF. RANK	SYNONYMS BY ORDER OF PREFERENCE	NOTES
Copy	To make an imitation, transcript or reproduction of.	Copy the tail number on the record form.	-		
Correct	To make or set right, to alter or adjust so as to bring to some standard or required condition.	Correct any error before proceeding with activity.	-		
Cover	To protect or shelter by placing something over or around.	Cover tires whenever maintenance is done on the aircraft.	-		
Crack	To open slightly (the throttle) of an aircraft engine preparatory to starting the engine.	Crack and lock the throttle to 1/8 open.	-		
Cut	To divide into parts using a sharp instrument such as a scissors or knife.	If the prongs of the cotter pin are too long, they should be cut to proper length.	-		
Cycle	To charge (a battery) for a short time.	Cycle the battery before making the specific gravity check.	2	1. Charge for a short time.	
Deflate	To release air or gas from.	Deflate the shock strut to check fluid level.	-		
Deflect	To move aircraft control surfaces (elevators, ailerons, etc.) to a position different from the major axes of the aircraft.	Deflect the surface upward to the mechanical stops.	-		
Deplete	To lessen markedly in quantity, content or power.	Deplete system pressure.	-		
Depress	To press or push down.	Depress both brake pedals	-		
Depressurize	To release gas or fluid pressure from.	Depressurize the hydraulic system.	-		
Destroy	To ruin, demolish or put out of existence; to make unfit for further use.	Destroy used hydraulic fuel containers.	-		
Detect	To discover or determine the existence, presence or fact of.	Watch very carefully so as to detect any needle movement.	-		
Determine	1. To obtain definite and first-hand knowledge of, to confirm or establish that a proper condition exists.	1. Determine that the light is off.	4	1. Be sure 2. Verify 3. Check 5. Ascertain	
	2. To investigate and decide, to discover by study or experiment.	2. Determine the amount of tension on a cable by following specified procedures.	1	2. Find	

VERBS	DEFINITIONS	EXAMPLES	PREF. RANK	SYNONYMS BY ORDER OF PREFERENCE	NOTES
Develop	To set forth or make clear by degrees or in detail.	Develop procedures fully.	-		
Devise	To form by new combinations or applications of ideas or principles; to invent.	Devise new methods of troubleshooting the system.	-		
Diagnose	To make an investigation or analysis of the cause or nature of a condition, situation or problem.	Diagnose the cause of the malfunction.	-		
Disassemble	To take to pieces; to take apart to the level of the next smaller unit or down to all removable parts.	Disassemble the No. 1 engine.	1	2. Dismantle	
Dismantle	To take to pieces; to take apart to the level of the next smaller unit or down to all removable parts.	Dismantle the No. 1 engine.	2	1. Disassemble	
Disconnect	1. To sever the connection between; to separate keyed or matched equipment parts.	1. Disconnect the bleedair hose from the leading edge anti-icing system.	-		
	2. To detach or separate (an electrical device) from a service outlet.	2. Disconnect the soldering iron from the service power outlet.	2	1. Unplug	
Disengage	To release or detach interlocking parts, to unfasten; to set free from an inactive or fixed position.	Disengage the parking brake.	2	1. Release 3. Unlock	For circuit breaker, use "open".
Dispatch	To send off or away with promptness or speed.	Dispatch report to supervizing technician.	-		
Dispose of	To get rid of.	Dispose of unused hydraulic fluid left in the can.	-		
Distribute	1. To apportion for a specific purpose or to particular persons or things.	1. Distribute the various maintenance tasks to technicians.	2	1. Assign 3. Allocate	
	2. To divide among several or many; to divide or separate, especially into kinds.	2. Distribute paint for various sections of the aircraft.	-		
Drain	To draw off (liquid) gradually or completely.	Drain servicing hose after removing it from the filter valve.	-		
Draw in	To pull (liquid) up into a container through suction.	Fill hydrometer by drawing in electrolyte.	-		
Dry	To cause to be free from water or liquid.	Dry bearings with low-pressure air.	-		

VERBS	DEFINITIONS	EXAMPLES	PREF. RANK	SYNONYMS BY ORDER OF PREFERENCE	NOTES
Effect	To do, carry out or bring about; to reach an objective.	Effect a periodic inspection on the landing gear.	3	1. Perform 2. Accomplish	
Eliminate	To expel; to ignore or set aside as unimportant.	Eliminate all unnecessary movement.	-		
Employ	To put into action or service, to carry out a purpose or action by means of; to avail oneself of.	Employ only antimagnetic fasteners.	3	1. Use 2. Utilize	
Enforce	To compel or constrain.	Enforce safety regulations	-		
Engage	To cause to interlock or mesh.	Engage threads of turnbuckle with threads of cable terminal.	-		For circuit breakers, use "close".
Enter	1. To go or come in.	1. Enter the aircraft through the troop doors.	-		
	2. To put on record.	2. Enter the data on the form.			
Erect	To put up by the fitting together.	Erect a special maintenance stand.	-		
Establish	To set on a firm basis.	Establish safety rules.	-		
Estimate	To judge or determine roughly the size, extent or nature of.	Estimate amount of cleaning solvent which will be necessary.	-		
Evaluate	To determine the importance, size or nature of; to appraise; to give a value or appraisal to on the basis of collected data.	Evaluate an operating engine	1	2. Assess	
Examine	To perform a critical visual observation or check for specific conditions; to test the condition of.	Examine the component for wear, deterioration or defects.	2	1. Inspect 3. Check	
Expedite	To accelerate the process or progress of.	Expedite the activity by assigning two men.	-		
Extend	To cause to be drawn out to fullest length.	Extend the main landing gear.	-		
Extract	To draw forth; to pull out forcibly.	Extract the cotter pin.	-		
Fabricate	To construct from standardized parts.	Fabricate rig pins from 0.25 inch rod.	-		
Figure	To determine by arithmetic processes.	Figure the voltage in a circuit with 10 amps of current and 5 ohms of resistance.	2	1. Calculate 3. Compute	
File	To rub smooth or cut away with a file (i.e., a tool with cutting ridges for forming or smoothing surfaces.)	File one end of the rod to a point.	-		

VERBS	DEFINITIONS	EXAMPLES	PREF. RANK	SYNONYMS BY ORDER OF PREFERENCE	NOTES
Fill	To put into as much as can be held or conveniently contained.	Fill oil and de-icing tanks.	-		
Find	1. To discover or determine by search; to indicate the place, site or limits of.	1. Find the No. 9 fitting.	2	2. Locate	
	2. To discover by study or experiment; to investigate and decide.	2. Find the amount of tension on a cable by following specified procedures.	2	1. Determine	
Flush	To pour liquid over or through: to wash out with a rush of liquid.	Drain and flush the hydraulic system if it is serviced with a wrong fluid.	-		
Follow	To accept as authority, to obey; to conform with directions or rules.	Follow directions.	1	2. Comply with	
Form	To give a particular shape to; to shape or mold into a certain state; to make up.	Form the compound so that it will fill the hole completely.	-		
Furnish	To supply what is needed, to equip.	Furnish a flashlight for man B.	2	1. Provide	
Go to	To proceed to; to transport oneself to a given destination.	Go to the control pedestal and position switches appropriately.	-		
Ground	To connect a current, wire or a piece of electrical equipment to a land or other specified surface.	Ground the servicing cart.	-		
Guard	To protect from danger, to defend.	Guard the area while maintenance is taking place.	-		
Guide	To manage or direct the movement of.	Guide the maintenance stand safely to its new position.	-		
Hand	To give, pass or transmit with the hands.	Hand the refueling hose to the technician stationed on the wing.	-		
Handle	To manipulate (load, turn, raise, etc.) objects and equipment manually or with specially designated equipment, such as hoists.	Handle charger cylinders carefully.	-		
Hang	To fasten to some elevated point without support from below, to suspend.	Do not hang tools on projecting parts of the aircraft.	-		
Help	To give support, aid or assistance to.	Help man B lift the load.	2	1. Assist 3. Aid	
Hold	To have or keep in the grasp.	Hold the power switch in position until the voltmeter stabilizes.	-		

VERBS	DEFINITIONS	EXAMPLES	PREF. RANK	SYNONYMS BY ORDER OF PREFERENCE	NOTES
Identify	1. To establish the identity of.	1. Identify components by name and function.	-		
	2. To determine the classification of a supply item.	2. Identify the component to be ordered from supply.	-		
Idle	To run an aircraft engine under reduced power without sufficient power being developed for movement of the aircraft.	Idle the engine for five minutes at 800 rpm.	-		
Immerse	To plunge into something that surrounds or covers, especially to plunge or dip into a fluid.	Immerse component in solvent.	-		
Improve	To make greater in amount or degree; to make better	Improve procedures whenever feasible.	-		
Indicate	To point out.	Indicate which dial should be monitored.	-		
Inflate	To fill with a given amount of gas or air.	Inflate tire to desired pressure.	-		
Inform	To make known to; to give notice or report the occurrence of.	Inform man B that the brakes have been set.	2	1. Report to 2. Notify 4. Advise	
Initiate	To perform actions necessary to set into operation, to set going, to begin.	Initiate operation of the powered AGE.	1	2. Start 3. Originate	
Inject	To throw, drive or force in.	Inject lubricant into proper joint.	-		
Insert	To put or thrust in, into or through	Insert a wire through the hole in the turnbuckle.	1	2. Put	
Inspect	To perform a critical visual observation or check for specific conditions; to test the condition of.	Inspect the components for wear, deterioration or defects.	1	2. Examine 3. Check	
Install	1. To perform operations necessary to properly fit an equipment unit into the next larger assembly or system.	1. Install fuel manifold	-		a. For wiring a circuit, use either "install wiring" or "wire". b. For safety wiring use either "safety wire" or "install safety wire". c. For screws, use "install screws" rather than "screw".
	2. To place and attach.	2. Install nuts on bolts.	-		

VERBS	DEFINITIONS	EXAMPLES	PREF. RANK	SYNONYMS BY ORDER OF PREFERENCE	NOTES
Install (Cont)					3. Use "cap" "plug" rather than install caps (plugs).
Insure	To make certain, to ensure.	Insure that the area is clear of unnecessary personnel and equipment.	-		
Intercept	To stop or interrupt the progress or course of.	Intercept messages between flight station and tail section technicians.	-		
Interpret	To explain the meaning of.	Interpret instructions for inexperienced technicians.	-		
Investigate	To observe or study by close examination and systematic inquiry.	Investigate the cause of the breakdown.	-		
Isolate	To use test equipment to identify or select a source of trouble.	Isolate the source of the malfunction using pressure gages.	-		
Jack	To use one or more jacks (i.e., mechanisms for exerting pressure to lift all or part of an aircraft.)	Jack and level the aircraft in accordance with specified procedures.	-		
Join	To bring or fit together so as to form a unit; to couple keyed or matched equipment items.	Join the torquometer to the socket wrench.	3	1. Connect 2. Mate	
Keep	To remain, to continue in a place.	Keep away from the danger area.	2	1. Stay	
Kick	To strike against with a foot.	Kick the wheel lightly if the strut binds.	-		
Latch	To catch with a device which holds a door when closed, even if not bolted.	Close and latch the aft petal doors.	-		
Leave	1. To go away from, depart.	1. Do not leave the area until this activity is complete.	-		
	2. To allot or provide for.	2. Leave a two-inch slack in the rope.	2	1. Allow	
Let	To permit; to give opportunity to.	Let the engine stabilize.	2	1. Allow	
Level	To cause an aircraft to become even or parallel with the plane of the horizon.	Jack and level the aircraft in accordance with specified procedure.	-		
Lift	To move or cause to be moved from a lower to a higher position; to elevate.	Lift the spoiler control lever to the ARMED position.	2	1. Raise	
Light	To cause to illuminate.	Light the field indicator light.	-		

VERBS	DEFINITIONS	EXAMPLES	PREF. RANK	SYNONYMS BY ORDER OF PREFERENCE	NOTES
Listen	To pay attention to sound	Listen to the engine while it is operating.	-		
Load	To place in or on a means of conveyance; to place cargo or aircraft components on an airplane or other vehicle.	Load and secure aircraft components on specified truck.	-		
Locate	1. To find, determine or indicate the place, site or limits of.	1. Locate the No. 9 fitting	1	2 Find	
	2. To set or establish in a particular spot, to station.	2. Locate the test equipment so that it can be seen by both technicians.	3-4	1. Position 2. Place 3-4. Set 5. Put	
Lock	To hold fast or inactive, to fix.	Lock the throttle after it has been properly set.	-		
Look for	To visually search for.	Look for cracks, security, corrosion and damage during inspection of wheels and tires.	-		
Loop	To make into the form or shape of a loop (i.e., a fold or doubling of line leaving an aperture between the parts through which another line can be passed)	Loop the wire.	-		
Loosen	To release from restraint, to cause to become less tight fitting.	Loosen the lock nut on the relief valve.	-		
Lower	To cause to move down; to depress as to direction.	Lower the exhaust stack into the stowed position.	-		
Lubricate	To put lubricant on specified locations.	Lubricate the wheel bearings.	1	2. Apply lubricant.	
Maintain	1. To hold or keep in any particular state or condition, especially in a state of efficiency or validity.	1. An aircraft mechanic maintains aircraft.	-		
	2. To sustain or keep up.	2. Maintain standard forms on power plant operations.	-		
Make	To carry out or cause to occur.	Make corrections where necessary.	-		
Mark	To label, to provide with an identifying or indicating symbol.	Mark each component before removing it.	-		If marking is to be done on a tag, use "tag".
Mate	To join or fit together, to couple.	Mate the torquometer to the socket wrench.	2	1. Connect 3. Join	

VERBS	DEFINITIONS	EXAMPLES	PREF. RANK	SYNONYMS BY ORDER OF PREFERENCE	NOTES
Measure	To determine the dimensions, capacity or amount by use of standard instruments or utensils.	Measure voltage drop across each unit of resistance.	-		
Mix	To combine or blend into one mass.	Never mix oxygen with other gases.	-		
Modify	To alter or change somewhat the form or qualities of.	A jet engine mechanic modifies turbofan engines.	-		
Monitor	1. To visually take note of, to pay attention to in order to check on action or change.	1. Monitor the indicator for changes in airspeed.	3	1. Observe 2. Watch	
	2. To continually or periodically attend to displays to determine equipment condition or operating status.	2. Monitor all engine instruments while starting the engines.	-		
Moor	To secure an aircraft to the ground by tying it down by ropes or cables.	Moor the aircraft when it is to be parked for an extended period of time.	-		
Mount	To attach to a support.	Mount the split-type wheel.	-		
Move	To change the location or position of.	Move and position a B-4 maintenance stand.			
Neutralize	To destroy the effectiveness of, to nullify, to make chemically neutral or electrically inert.	Neutralize the solution before applying it to aircraft surface.	-		
Notify	To make known to; to give notice or report the occurrence of.	Notify man B that the brakes have been set.	3	1. Report to 2. Inform 4. Advise 5. Communicate to	
Observe	1. To conform one's actions or practice to.	1. Observe precautions.	-		
	2. To visually take note of, to pay attention to.	2. Observe the indicator for changes in airspeed.	1	2. Watch 3. Monitor	
Obtain	1. To get or find out by observation or special procedures.	1. Obtain a reading on the outside circle of the tensiometer.	2	1. Take	
	2. To gain or attain.	2. Obtain the necessary supplies before starting on maintenance.	-		
Open	1. To move from closed position; to make available for passage by turning in an appropriate direction.	1. Open the valve.	-		
	2. To make available for entry or passage by turning back, removing or clearing away.	2. Open the troop door.	-		
	3. To disengage or pull.	3. Open the appropriate circuit breakers.	-		

VERBS	DEFINITIONS	EXAMPLES	PREF. RANK	SYNONYMS BY ORDER OF PREFERENCE	NOTES
Operate	To control equipment in order to accomplish a specific purpose.	Operate crew stands and auxiliary power equipment.	-		
Order	1. To requisition or request from supply.	1. Order three cans of appropriate solvent.	-		
	2. To group according to quality, value, or other characteristics.	2. Order components by size from smallest to largest.	2	1. Arrange	
Organize	To arrange elements into a whole of interdependent parts; to form into a coherent unity; to integrate.	Organize the activities of the assisting technicians.	-		
Orient	1. To acquaint with the existing situation or environment.	1. Orient new technicians to location of shops and supplies.	-		
	2. To set or arrange in any determinate position.	2. Orient the aircraft away from wind direction.	-		
Originate	To give rise to, to set going, to begin.	Originate a new procedure.	3	1. Initiate 2. Start	
Overhaul	The act of disassembling equipment units down to all removable parts; cleaning; critically inspecting, repairing, restoring and replacing where necessary; assembling, adjusting, aligning, recalibrating and verifying operational readiness by test or checkout; and packaging for transportation storage.	Overhaul the No. 2 engine.	-		
Pack	To fill completely with grease.	Pack the bearings.	-		
Paint	To apply color or pigment (suspended in suitable liquid) to the surface of.	Paint all exposed surfaces.	-		
Park	To bring (an aircraft) to a stop and leave it standing for a time, usually without pilot, in a specified area.	Park the aircraft between the yellow lines.	-		
Patch	To mend, cover, or fill up a hole or weak spot in.	Patch the tubes where necessary.	-		
Perform	To do, carry out or bring about; to reach an objective.	Perform a periodic inspection on the landing gear.	1	2. Accomplish 3. Effect	
Place	To put or set in a desired location or position.	Place the test equipment so that it can be seen by both technicians.	2	1. Position 3-4. Set 3-4. Locate 5. Put	
Plan	To devise or project the achievement of.	Plan the day's schedule for the technicians.	-		

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VERBS	DEFINITIONS	EXAMPLES	PREF. RANK	SYNONYMS BY ORDER OF PREFERENCE	NOTES
Plug	To provide with a device for closing off the end of a tube which has a female fitting.	Plug all lines which have exposed female fittings.	1	2. Insert plugs 3. Install plugs	
Plug in	To attach or mate (an electrical device) to a service outlet.	Plug in the soldering iron at the service power outlet.	1	2. Connect	
Position	To put or set in given place; to locate.	Position the test equipment so that it can be seen by both technicians.	1	2. Place 3-4. Set 3-4. Locate 5. Put	
Post	To station at a given place.	Post one man in front of the aircraft.	-		
Prepare	To make ready; to arrange things in readiness.	Prepare the surface for paint.	-		
	To prepare or make ready for a maintenance activity.	Prepare the Trunion Shaft Kit for removal of the MLG shock strut.	1	2. Set up 3. Ready	
Prescribe	To lay down as a guide, direction or rule of action; to specify with authority.	Prescribe repair activities to correct the malfunctions.	-		
Pre-set	To put in a desired position, adjustment or condition beforehand.	Pre-set tension indicator dial to size of cable being checked.	-		
Press	To act upon through thrusting force exerted in contact.	Press the blower start button.	1	2. Push	For circuit breakers, use "close".
Pressurize	To apply pressure within by filling with gas or liquid.	Pressurize the booster hydraulic system.	-		
Prevent	To keep from happening or existing.	Prevent oil from spilling over on components.	-		
Probe	To investigate thoroughly with a long, pointed device or by direct feeling.	Probe the tube with fingers.	-		
Process	To submit to a series of actions or operations leading to a particular end.	Process the forms so they will be compatible with new recording methods.	-		
Program	To work out a plan or procedure or a sequence of operations to be performed.	Program the maintenance activity in logical sequence.	-		
Provide	To supply what is needed, to equip.	Provide a flashlight for man B.	1	2. Furnish	
Pull	To exert force upon an object so as to cause motion toward the force.	Pull out knob No. 6 on the oxygen servicing cart.	-		For circuit breakers, use "open".

VERBS	DEFINITIONS	EXAMPLES	PREF. RANK	SYNONYMS BY ORDER OF PREFERENCE	NOTES
Pump	1. Raise or lower by operating a device which raises, transfers or compresses fluids by suction, pressure or both.	1. Pump up the ramp several inches.	-		
	2. To move up and down or in and out as if with a pump handle.	2. Pump engine primer knob.	-		
Puncture	To pierce with pointed instrument or object.	Be careful not to puncture tube while probing the inside of it.	-		
Purge	1. To free of sediment or trapped air by flushing or bleeding.	1. Purge fuel tanks.	-		
	2. To remove fuel or fuel vapors from engine by motoring engine with fuel switch off.	2. Purge engines.	-		
Push	1. To press against with force so as to cause motion away from the force.	1. Push the blower start button.	2	1. Press	For circuit breakers, use "close".
	2. To move away or ahead by steady pressure.	2. Push the servicing cart toward the aircraft.	-		
Put	1. To place in or through.	1. Put a wire through the hole in the turnbuckle.	2	1. Insert	
	2. To place or set in a desired position or location.	2. Put the test equipment where it can be seen by both technicians.	5	1. Position 2. Place 3-4. Set 3-4. Locate	
	3. To deposit or leave.	3. Put tools out on the bench.	-		Use "store" instead of "put away" for depositing or leaving in a specified place for future use.
	4. To lay or spread on or in.	4. Put sealant in the gap between the windshield and the aircraft structure.	1	1. Apply.	
Qualify	To declare competent or adequate.	Qualify components which checkout successfully.	-		
Raise	To move or cause to be moved from a lower to a higher position, to elevate.	Raise the spoiler control lever to the ARMED position.	1	2. Lift	
Read	To interpret the meaning of by visual observation.	Read the ammeter.	-		
Readjust	To adjust again, to move back to a specified condition; to bring back to an in-tolerance condition.	Readjust the voltage after performing an operational check of the system.	-		

VERBS	DEFINITIONS	EXAMPLES	PREV. RANK	SYNONYMS BY ORDER OR PREFERENCE	NOTES
Ready	To prepare for a maintenance activity.	Ready the Trunnion Shaft Kit for removal of the MLG shock strut.	3.	1. Set up 2. Prepare	
Reassemble	To refit and secure together the parts of after they have been taken apart.	Reassembly component before installation on aircraft.	-		
Recall	To call back.	Recall parts which have not been modified.	-		
Recap	To cap again; to replace a covering; to reinstall a fitting for closing the end of a tube.	Recap the filler valve.	-		
Recapitulate	To repeat briefly.	Recapitulate the task sequence.	-		Use "repeat briefly."
Receive	To come into possession of; to get.	Receive supplies as they arrive.	-		
Recognise	To perceive to be something previously known or designated.	A jet engine mechanic recognized troubles through evaluation of engine operational checks.	-		
Recommend	To urge the acceptance or use of.	Recommend procedure changes where appropriate.	-		
Recondition	To renew; to bring or put back into good condition.	Recondition the pilot's and copilot's seats.	1	2. Renovate	
Reconnect	To rejoin or refasten hat which has been separated.	Reconnect aft pistons to forward pistons.	-		
Record	To set down in writing.	Record maintenance time on appropriate form.	-		
Reduce	To cause to be diminished in strength, density or value.	Reduce pump flow.	-		
Refuel	To put fuel into the tanks of (an aircraft) again.	Refuel the system as outlined from applicable technical manuals.	-		
Regulate	To fix or adjust the time, amount or rate of; to exercise restraining or directing influence over.	Regulate electrical current generation and distribution.	1	2. Control	
Reinflate	To refill with a given amount of gas or air after deflation has occurred.	Reinflate tires to specified psi value.	-		
Reject	To refuse to have, use or take for some purpose.	Reject components which show excessive wear.	-		
Relay	To pass along by stages.	Relay the message to man D.	-		

VERBS	DEFINITIONS	EXAMPLES	PREF. RANK	SYNONYMS BY ORDER OF PREFERENCE	NOTES
Release	1. To set free from an inactive or fixed position; to unfasten or detach interlocking parts.	1. Release the parking brake.	1	2. Disengage 3. Unlock	
	2. To let go of.	2. Release tensionmeter handle.	-		
	3. To set free from restraint or confinement.	3. Release pressure.	-		
Relieve	To ease or set free of a burden, to partially release.	Relieve hydraulic pressure before working on a system.	-		
Remove	1. To perform operations necessary to take an equipment unit out of the next larger assembly or system.	1. a. Remove bleed air shutoff valves. b. Remove bolts from nuts.	-		For screws, use "remove" rather than "unscrew".
	2. To take off or eliminate.	2. Remove paint.	-		
	3. To take or move away.	3. Remove jacks.	-		
	4. To take off devices for closing off the end of a tube.	4. Remove caps (plugs) from all hydraulic lines.	1	2. Uncap (unplug)	
Renovate	To renew; to bring or put back into good condition.	Renovate the pilot's and copilot's seats.	2	1. Recondition	
Repair	To restore damaged, wornout or malfunctioning equipment to a serviceable, usable or operable condition.	Repair engine by replacing parts and removing defects.	1		Repair includes replacement, overhaul and reworking of constitutent parts or materials.
Repeat	To make, do or perform again.	If keys do not engage lugs, remove wheel assembly and repeat procedure.	-		
Replac	1. To restore to a former place or position.	1. Replace covers on jacks.	1		
	2. To substitute serviceable equipment for malfunctioning, wornout or damaged equipment.	2. Replace the switch contact points.	1	2. Change	
Replenish	To fill or build up again.	Replenish drinking water when supply runs low.	-		
Report	To describe as being in a specified state.	Report when ready.	1	2. Inform 3. Notify 4. Advise 5. Communicate to	
	To make known to; to give notice or report the occurrence of	Report to man 3 that the brakes have been set.			
Repressurize	To reapply pressure within by filling with gas or liquid after pressure has been released.	Repressurize the utility hydraulic system.	-		
Request	To ask for.	Request further information if necessary.	-		

TERMS	DEFINITIONS	EXAMPLES	PREF. RANK	SYNONYMS BY ORDER OR PREFERENCE	NOTES
Reset	To put back into a desired position, adjustment or condition.	Reset the field after performing an operational check of the generator.	-		
Resolve	To clear up or find an answer to; to reach a decision about.	Resolve the inconsistentency before proceeding with maintenance activity.	-		
Restore	To bring back or put back into a a former or original state.	Restore hydraulic pressure.	-		
Retard	To manipulate so as to hold back or slow down, to hold back or slow down.	Retard the throttle.	-		
Retract	To draw up against or into the aircraft.	Retract the landing gear.	-		
Return	To bring, send or put back to a former or proper place.	Return the horizontal stabilizer to the neutral position.	-		
Review	To examine again; to go over or examine critically or deliberately.	Review procedures which have not been performed for more than two months.	-		
Rework	To reprocess for further use; to revise.	Rework the report forms.	-		
Rig	To assemble, adjust and align the major components of an aircraft (i.e. airfoils or other surfaces); to fit out (an aircraft) with control cables, bracing cables, pulleys, turnbuckles, etc.	Rig and adjust the mechanical linkage in the flight control system.	-		
Rinse	To cleanse (as from soap used in washing) by clear water.	Rinse the battery after cleaning it with soda water solution.	-		
Rope off	To partition, separate or divide by a rope (i.e., a large stout cord of strands of fibers or wire twisted or braided together).	Clear and rope off an area around the aircraft and post warning signs.	-		
Rotate	To cause to revolve about an axis or center.	Rotate the door handle counter clockwise until latches retract.	1	2. Turn	
Route	To send by a selected course of travel; to divert in a specified direction.	Route the memo to all affected personnel.	-		
Rub	To move along the surface of a body with pressure.	Rub hands around connections.			

VERBS	DEFINITIONS	EXAMPLES	PREF. RANK	SYNONYMS BY ORDER OF PREFERENCE	NOTES
Safeguard	To provide a technical contrivance to prevent accident; to comply with precautionary measures or stipulation.	Safeguard technical manuals	-		
Safety	1. To secure an aircraft part against loosening from vibration.	1. Safety the lock nut on the relief valve.	-		
	2. To use safety wire to make an aircraft component fast or safe or secure against loosening from vibration.	2. Safety the bolts with wire.	3	1. Safety wire. 2. Secure (with wire) 4. Install (with wire)	
	3. To use a cotter pin to make an aircraft component fast or safe or secure against loosening from vibration.	3. Safety the bolt with a cotter pin.	3	1. Secure 2. Install	
Safety wire	To use safety wire to make an aircraft component fast or safe or secure against loosening from vibration.	Safety wire the bolts.	1	2. Secure (with wire) 3. Safety 4. Install (with wire)	
Salvage	To rescue or save (as from discard, wreckage or ruin).	Salvage fuel which is drained from tanks.			
Scan	To make a wide, sweeping search of; to look through or over hastily.	Scan the flight engineer's panels before beginning maintenance activity.	-		
Schedule	To appoint, assign or designate for a fixed future time; to make a time-table of.	Schedule maintenance activities for the day.	-		
Screw	1. To attach, fasten or close by means of a screw	1. Screw the ram safety lock to the ram.	-		
	2. To attach by means of a twisting motion in the proper direction.	2. Screw in jack pad.	-		
	3. To attach screws by means of a twisting motion in the proper direction.	3. Screw in twelve screws around cover.	2	1. Install	
Scrub	To clean with hard rubbing.	Scrub all metal parts with a white powder deposit on them.	-		
Secure	1. To make fast or safe.	1. Load and secure components on trucks.	-		
	2. To safety (with safety wire or cotter pin) to make aircraft component fast or safe or to keep it from loosening during vibration.	2. a. Secure bolts with safety wire	2	1. Safety wire 3. Safety 4. Install (with wire)	
		b. Secure the bolt with a cotter pin.	1	2. Install 3. Safety	

VERBS	DEFINITIONS	EXAMPLES	PREF. RANK	SYNONYMS BY ORDER OR PREFERENCE	NOTES
Select	To take by preference or fitness from a number or group, to pick out, to choose.	Select a battery cell and insert hydrometer nozzle in the cell.	-		
Service	To perform such operations as cleanup, lubrication and replenishment to prepare for use.	Service each battery cell to only 3/8 inch above the plates.	-		
Set	1. To put a switch, pointer or knob into a given position; to put equipment into a given adjustment, condition a mode.	1. Set PWR switch to ON	-		
	2. To put or place in a desired orientation or location.	2. Set the test equipment so that it can be seen by both technicians.	3-4	1. Position 2. Place 3-4. Locate 5. Put	
Set up	To prepare or make ready for a maintenance activity.	Set up the Trunnion Shaft Kit for removal of the MLG shock strut.	2	1. Prepare 3. Ready	
Shake	To move or cause to move to and fro in a quick, jerky manner.	Shake the container so that the paint will be well mixed.	-		
Shut down	To perform operations necessary to cause an equipment to cease or suspend operation.	Shut down the air conditioning	1	2 Stop	
Signal	To notify or communicate by signals (i.e., a prearranged sign, notice or symbol conveying a command, warning, direction or other message).	Signal the pilot to move the the aircraft to the left.	-		
Simulate	To give the appearance or effect of.	Simulate doppler radar signals	-		
Slide	To cause to move in a smooth manner over a surface.	Slide the stand in close enough to do the work.	-		
Specify	To name or state explicitly or in detail.	Specify the manufacturer's number of the multimeter.	-		
Spill	To cause or allow to fall, flow or run out.	Be careful not to spill battery acid on clothing, hands.	-		
Spin	To cause to revolve rapidly.	Spin wheel by hand until a bearing drag is noticed.	-		
Spray	To apply with a device which disperses a jet of finely divided liquid.	Spray the fuselage and tail sections moving from center to ends.	-		
Start	To perform actions necessary to set into operation, to set going, to begin.	Start the powered AGE	2	1. Initiate 3. Originate	
Stay	To remain, to continue in a place.	Stay away from the danger area.	1	2. Keep	
Stimulate	To excite to activity or greater activity.	Stimulate flow by warming the lines.	-		
Stop	To perform actions necessary to cause an equipment to cease or suspend operation.	Stop the air conditioning	2	1. Shut down.	

VERBS	DEFINITIONS	EXAMPLES	PREF. RANK	SYNONYMS BY ORDER OR PREFERENCE	NOTES
Store	To deposit or leave in a specified place for future use.	Store the wheel covers after maintenance activity is completed.	1	2. Stow 3. Put away	
Stow	To deposit or leave in a specified place for future use.	Stow the wheel covers after maintenance activity is completed.	2	1. Store 3. Put away.	
Strike	To deliver or aim a blow or thrust, to hit.	Strike the designated spot with a hammer.	-		
Submit	To make available, to offer.	Submit request for modification of procedures.	-		
Suggest	To propose as desirable or fitting; to offer for consideration.	Suggest any changes which might be helpful.	-		
Superintend	To oversee; to have or exercise the the charge of.	Superintend the repair of the engines.	2	1. Supervise	
Supervise	To oversee; to have or exercise the charge of.	Supervise the repair of the engines.	1	2. Superintend	
Support	To hold up or provide a foundation or props for.	Support the elevator at both ends.	-		
Survey	To examine comprehensively as to condition, situation or value.	Survey entire aircraft surface.	-		
Synchronize	To cause to happen at the same time.	Synchronize the activities of man A and man B.	-		
Tabulate	To set up in the form of a table (with rows and columns); to compute by means of a table.	Tabulate maintenance times for each occurrence of the various maintenance activities.	-		
Tag	To provide with an identifying or indicating symbol with or as if with a tag (i.e., a cardboard, plastic or metal marker used for identification or classification); to label.	Tag each hydraulic line before removing it.	1	2. Attach a tag. 3. Mark 4. Connect a tag to	
Take	1. To get into or carry in one's hands or one's possession.	1. Take supplies out to the aircraft.	-		
	2. To get or find out by observation or special procedures.	2. Take a reading on the outside circle of the tensiometer.	1	2. Obtain	

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VERBS	DEFINITIONS	EXAMPLES	PREF. RANK	SYNONYMS BY ORDER OR PREFERENCE	NOTES
Tap	To strike lightly.	Tap the eye of the cotter pin to seat it.	-		
Test	To perform specified operations to verify operational readiness of a component, subcomponent, system or subsystem.	Test the true airspeed indicator.	2	1. Checkout	
Throw	To move (a switch) so as to make or break a connection.	Throw switch to ON position.	-		Use "set" for all switches.
Tie	To fasten, attach or close by means of a line or cord.	Tie moorning ropes to tie points under wing and on nose.	-		
Tighten	1. To perform necessary operations to fix more firmly in place.	1. Tighten all screws.	-		
	2. To apply a specified amount of force to produce a rotation or twisting motion to fix more firmly in place.	2. Tighten the nut to a torque value of 1000 inch-pounds.	1	1. Torque	
Tilt	To cause to slope, lean or incline.	Tilt maintenance stand backwards until wheels contact the ground.	-		
Torque	To apply a specified amount of force to produce a rotation or twisting motion to fix more firmly in place.	Torque the nut to 1000 inch -pounds.	1	2. Tighten	Torque (noun) = length of wrench handle times applied force.
Tow	To pull along (an aircraft) by means of a towing vehicle and tow bar.	Tow aircraft to the wash-rack.	-		
Trace	To follow or study out in detail or step by step.	Visually trace the wiring diagram.	-		
Transfer	To convey or cause to pass from one place to another.	Transfer fuel and oil from one place to another.	1	2-3. Transport 2-3. Transmit	
Transmit	1. To convey or cause to pass from one place to another.	1. Transmit fuel and oil from one place to another.	2-3	1. Transfer 2-3. Transport	
	2. To send out a signal by radio waves or wire.	2. Transmit message to control tower.	-		
Transport	1. To convey or cause to pass from one place to another.	1. Transport fuel and oil from one tank to another.	2-3	1. Transfer 2-3. Transmit	
	2. To carry by hand or in a vehicle or hoist, or in a container, etc.	2. Transport landing gear to shop on dolly.	-		

VERBS	DEFINITIONS	EXAMPLES	PREF. RANK	SYNONYMS BY ORDER OR PREFERENCE	NOTES
Trim	1. To free of excess or extraneous matter by or as if by cutting.	1. Trim patch to fit.	-		
	2. To adjust (a jet engine) to compensate for wear.	2. Trim the No. 1 engine.	-		
Troubleshoot	To localize, isolate and correct the source of a malfunction or breakdown.	Troubleshoot the landing gear control circuit.	-		
Tune	To adjust for precise functioning.	Tune the transmitter for maximum output.	-		
Turn	To cause to revolve about an axis or center.	Turn the door handle counter clockwise until latches retract.	2	1. Rotate	
Turn off	To shut off or stop the flow of by or as if by moving a control to its OFF position.	Turn off power to the signal generator.	-		
Turn on	To cause to flow or operate by or as if by moving a control to its ON position.	Turn on power to the signal generator.	-		
Uncap	To remove a device for closing off the end of a tube with a male fitting.	Uncap and unplug all hydraulic lines.	2	1. Remove caps.	
Unlock	To set free from an inactive or fixed position, to unfasten, to detach interlocking parts.	Unlock the parking brake.	2	1. Release 2. Disengage	
Unplug	1. To detach or separate (an electrical device) from a service outlet.	1. Unplug the soldering iron.	1	2. Disconnect	
	2. To remove a device for closing off the end of a tube with female fittings.	2. Unplug and uncap all hydraulic lines.	2	1. Remove plugs	
Unscrew	1. To loosen or withdraw by turning in the proper direction.	1. Unscrew the jack pad.	-		
	2. To draw the screws from.	2. Unscrew twelve screws around cover.	2	1. Remove	
Unwind	To cause to uncoil or unroll.	Unwind hoses from hose rack.	-		
Use	To put into action or service; to avail oneself of; to carry out a purpose or action by means of.	Use only antimagnetic fasteners.	1	2. Utilize 3. Employ	
Utilize	To put into action or service; to avail oneself of; to carry out a purpose or action by means of.	Utilize only antimagnetic fasteners.	2	1. Use 3. Employ	
Verify	1. To confirm or establish that a proper condition exists.	1. Verify that the light is off.	2	1. Be sure 3. Check	
	2. To establish the truth or accuracy of.	2. Verify the readings before recording them	-	4. Determine 5. Ascertain	

VERBS	DEFINITIONS	EXAMPLES	PREF. RANK	SYNONYMS BY ORDER OF PREFERENCE	NOTES
Wait	To suspend activity in a sequence of activities until a given condition occure or a given time has elapse	Wait five minutes before performing the next task.	-		
Wash	To cleanse by or as if by the action of liquid: to remove (dirt) by rubbing or drenching with liquid.	Wash the battery with a cleaning solution and a stiff brush.	-		
Watch	To visually take note of, to pay attention to in order to check on action or change.	Watch the indicator for changes in airspeed.	2	1. Observe 2. Monitor	
Wire	To provide with wire, to use wire on.	Wire the circuit.	1	1. Install wiring.	
Withdraw	To take back, away, or out.	Withdraw the bar magnet from the center of the coil.	-		
Wrap	To wind, coil or twine so as to encircle or cover something.	Wrap the wire around the terminal.	-		
Zero	To bring to a desired level or null position.	Zero the protractor to the surface.	-		

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13. ABSTRACT

This report describes the latest phase in the program to develop and evaluate PIMO (Presentation of Information for Maintenance and Operation); a job guide concept applied to maintenance. Between August 1968 and April 1969, a test was conducted at Charleston AFB, South Carolina, to determine the effectiveness of PIMO. Three immediate behavioral effects were expected: 1) reduction in maintenance time, 2) reduction in maintenance errors, and 3) allow usage of inexperienced technicians with no significant penalty. Experienced and inexperienced Air Force technicians performed maintenance on C-141A aircraft using PIMO Job Guides presented in audio-visual and booklet modes. Performance was measured in terms of time to perform and procedural errors. The performance was compared with the performance on the same jobs by a control group, i.e., experienced technicians performing in the normal manner. The following conclusions were drawn from the test results: 1) after initial learning trials, both experienced and inexperienced technicians using PIMO can perform error-free maintenance within the same time as experienced technicians performing in the normal manner, 2) inexperienced technicians perform as well as experienced technicians when both use PIMO, 3) there is no significant difference between audio-visual and booklet modes, 4) the users revealed an overwhelmingly positive reaction to PIMO, and 5) the performance improvements provide the capabilities to significantly improve system performance defined in terms of departure reliability, time-in-maintenance, and operational readiness. This report also presents a description of the recommended operational system, specifications and guidelines for PIMO format development, including troubleshooting.

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KEY WORDS	LINK A		LINK B		LINK C	
	ROLE	WT	ROLE	WT	ROLE	WT
Maintenance Aids, Improved Job-oriented Guides Aircraft Maintenance Troubleshooting Aids Field Test of Maintenance Aids Audio-visual Presentation, Maintenance Data Maintenance Dependency Charts, Preparation of PIMO, Programmed Information for Maintenance Technical Data, Reformatting of Technical Data, Specifications for Technical Orders, Comparison of (with PIMO) PIMO, Project Final Report						

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It is highly desirable that the abstract of classified reports be unclassified. Each paragraph of the abstract shall end with an indication of the military security classification of the information in the paragraph, represented as *(TS), (S), (C), or (U)*.

There is no limitation on the length of the abstract. However, the suggested length is from 150 to 225 words.

14. KEY WORDS: Key words are technically meaningful terms or short phrases that characterize a report and may be used as index entries for cataloging the report. Key words must be selected so that no security classification is required. Identifiers, such as equipment model designation, trade name, military project code name, geographic location, may be used as key words but will be followed by an indication of technical context. The assignment of links, rules, and weights is optional.

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